AUGUST • 1960

TOOL & DIE JOURNAL

DESIGN, MANUFACTURE AND USE OF PRODUCTION TOOLING

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- ★ Non-irritating . . . doesn't grow rancid.

The Multi-Purpose Cutting Fluid

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DIVISION OF THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO, U. S. A.

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CONTENTS

Feature Articles Index 77
Editorial 79
Feature Articles 80
Shop Data Sheets 97
Industrial Digest 103
Inform-A-Gram 106A
Where Can I Buy It? 107
Progress-on-Parade 108
Shop Aids 123
Publication Previews 125
Contract Tooling and Production 165
The Curb 167
Advertisers' Index 168

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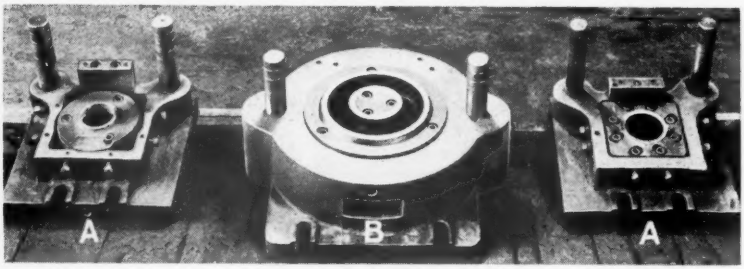
HAYNES STELLITE alloy prolonged the life of these hot-work dies... *and reduced replacing time*



	No. of Pieces Between Repairs	*Hours Required to Replace Die*
A—Hot-Trimming Die for Rear Axle Differential Gear	Steel—4,000 Hard-Faced—20,000	Steel—16 Hard-Faced—6
B—Hot Trimming and Piercing Die for Ring Gear	Steel—2,500 Hard-Faced—15,000	Steel—20 Hard-Faced—12

These hot-work dies—used in the plant of a large motor manufacturer—were hard-faced with abrasion-resistant HAYNES STELLITE alloy. These hard-faced dies have outlasted steel dies 5 to 6 times, and they can be repaired in less than half the time required for replacing ordinary dies.

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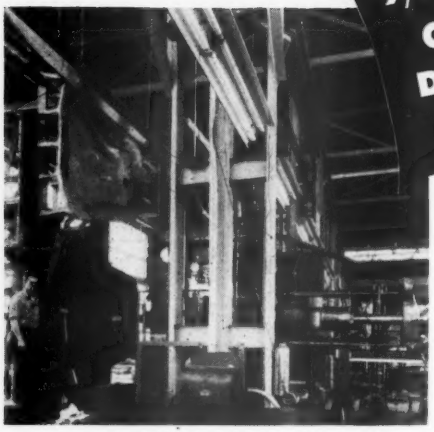

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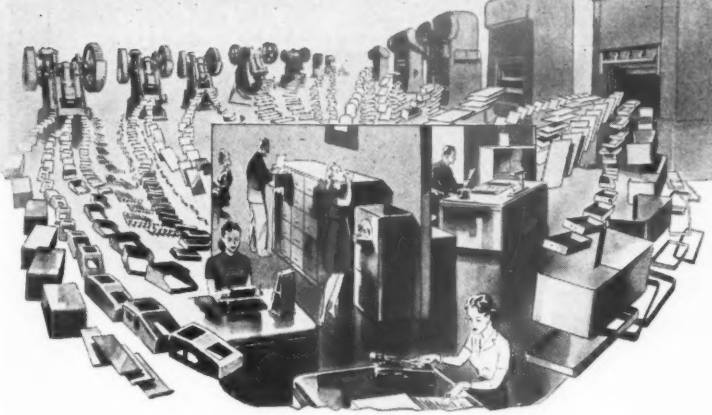

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The clean lines and rounded contours of modern office furniture and equipment—the innumerable duplicated parts in typewriters, calculators and other office machines are ideally suited to Press Production. The Punch Press is the best and fastest method of duplicating parts for the vast field of industrial and business machines; and the entire Stamping Industry recognizes Danly Die Sets as vital in speeding die making programs, press production, and eliminating "downtime" because Danly means *known dependable accuracy*.

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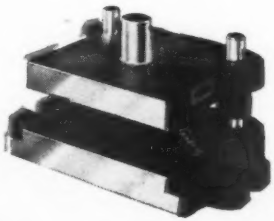

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Which Kind of Diamond Wheel is Best for Your Carbide Grinding?

NORTON Has 3 Types of Bond: Vitrified · Metal · Resinoid

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This job "couldn't be done"—

but FIRTHITE did it!

CONDITIONS

- Depth of cut.....1/32" to 1/16"
- Feed per revolution.....0.015"
- Cutting speed.....800 feet per minute
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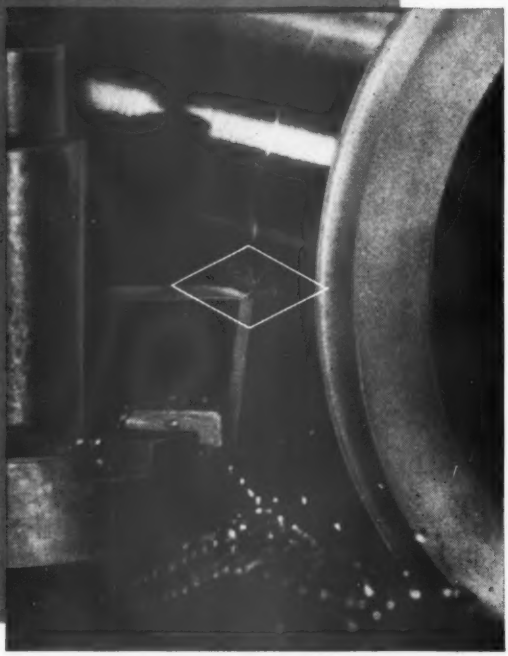
The parts on this job of turning silicon electrical sheet laminated rotors were not machineable with ordinary cutting materials, and required grinding.

Firthite sintered carbide was the answer. It finished the parts accurately and smoothly (no grinding needed), and produced 75 rotors between tool changes.



If you have a cutting problem—

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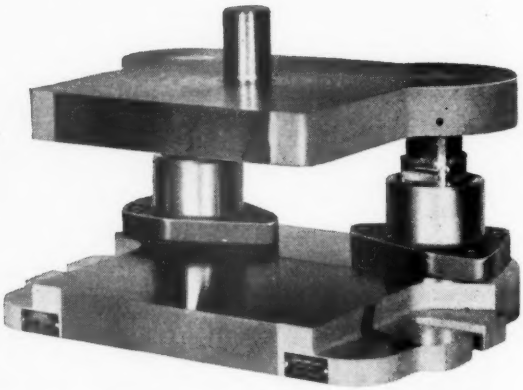

with MICROLEX ANTI-FRICTION DIE SETS

Now Evans offers you the perfect companion pieces for expensive tools and dies. They are Microlex Anti-Friction Die Sets.

Microlex Die Sets have ball or roller bearing guide pins. As a result they make it possible for you to produce parts faster, to tighter limits of accuracy and reduce scrap loss.

Here's why:

Anti-friction guide pins reduce die setter's time . . . enable you to get into production quicker . . . permit fast press speeds. Microlex Die Sets eliminate all down time caused by bound, scored or galled pins. Bearings on these sets have pre-load of .0015″ which prevents all possibility of play between guide pins and bushings . . . assures positive accuracy.

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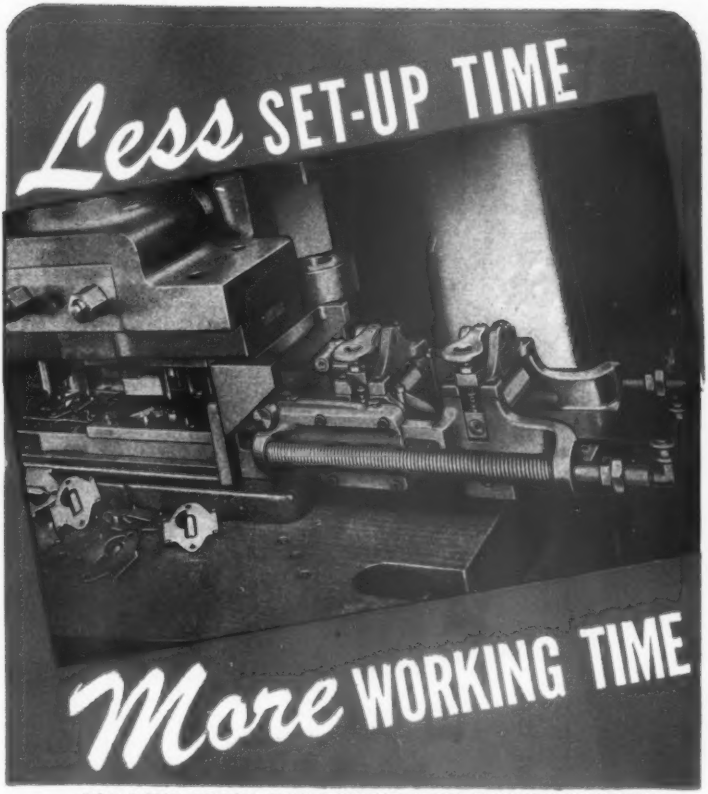

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These accurate, automatic feeds require no connection with the power shaft of your punch press. They save labor time and material waste, both for day-in-and-day-out production and on short runs.

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1. Feeds from any position on any style die.
2. Saves time on both long and short runs.
3. Offers positive feed control, adjustable from 0" to its limit.

Made in two sizes, 2" and 4" Feeds
Send for booklet

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2. Adjustable from 0" to its maximum feed length in increments of .001".
3. Fasten three screws — and it's mounted on your die set.

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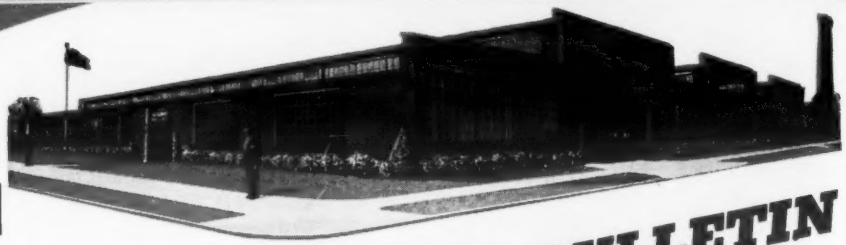

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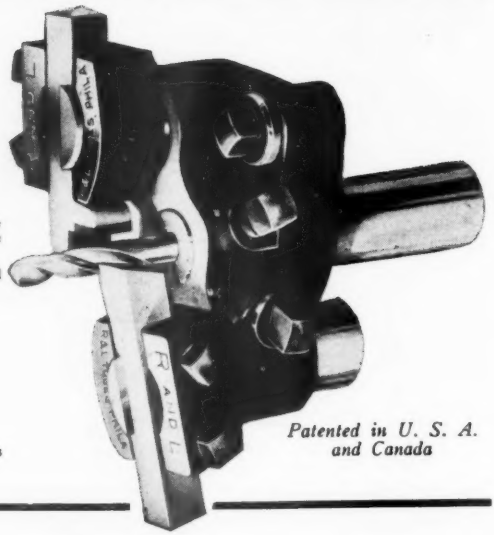
1=14 @ 1/4 The Cost

When The Tool Is an R and L Combination Turning Tool



Patented in U. S. A. and Canada

One R and L Combination Turning Tool, the only combination right hand and left hand tool on the market, actually does the work of 14 tools.

You can use an R and L for all these right hand or left hand applications:

- **Roller Box Tool**
- **Centering and Facing Tool**
- **Knee Tool**
- **Pointing Tool**
- **Back Rest**
- **Floating Drill Holder**
- **Balanced Turning Tool**

The change from right to left or vice versa takes only ten seconds.

√ *CHECK THESE OUTSTANDING FEATURES*

- **Made of extra tough, heat treated alloy steel; unconditionally guaranteed not to bend or give way.**
- **Essential parts ground to extreme accuracy affording perfect alignment at any point of adjustment.**
- **Back Rests, or burnishers, have almost diamond hard surfaces eliminating metal pick-up and marring of work surface.**
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All these and many other features are shown by photographs and drawings in descriptive booklet mailed without cost or obligation. The booklet illustrates the tool set-up for various operations, and indicates speed and simplicity of its adaptation to various jobs. Prices and full specifications of many available sizes are included. Write for your copy today.

R and L TOOLS *1825 Bristol St., Philadelphia 40, Pa.*

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Solid Carbide and Carbide Tipped TWIST DRILLS

For drilling in abrasive materials such as plastics, non-ferrous metals, etc., where long-wearing qualities are needed and risk of breakage is low. On many jobs in the classifications outlined above, hard, wear-resistant Super Carbide Tipped and Solid Carbide Twist Drills set new standards of economy. Like all Super products, Super Carbide Tipped and Solid Carbide Twist Drills are manufactured under precision-controlled processing conditions which assure finest drill quality and performance. Their superior wearing qualities insure faster work — less down time — faster production.

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Carbide Tipped Tools

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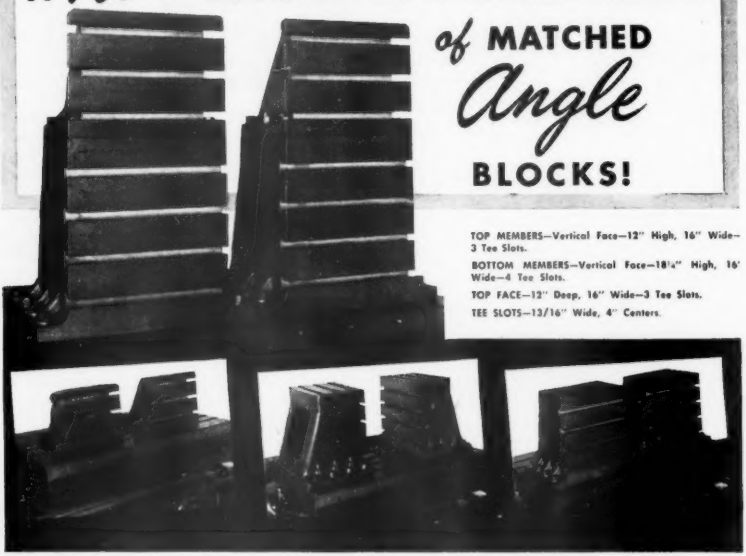

TOP MEMBERS—Vertical Face—12" High, 16" Wide—3 Tee Slots.

BOTTOM MEMBERS—Vertical Face—18¼" High, 16" Wide—4 Tee Slots.

TOP FACE—12" Deep, 16" Wide—3 Tee Slots.

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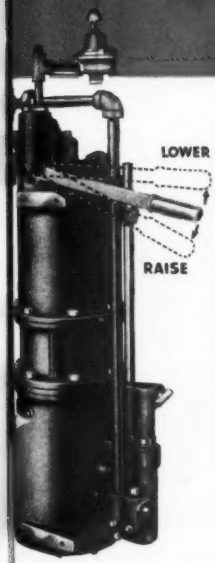
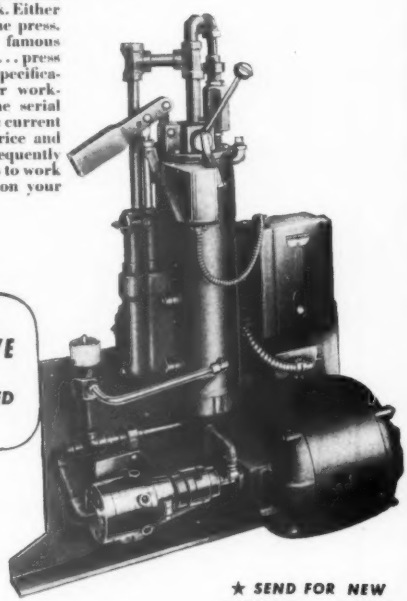
. . . FOR HIGH PRODUCTION WITH EITHER AIR-OIL OR MOTOR-DRIVEN POWER UNITS



● Thousands of standard KRW Hydraulic Arbor Presses can now be power equipped for production use by adding the new KRW Power Units. These units . . . either air-oil or motor-driven . . . are available for 25, 50, 60 and 75-ton KRW standard presses. When power equipped, and utilizing simple, inexpensive dies, these standard presses are adaptable to a great many bending, forming, stamping and straightening operations . . . relieving heavier and more expensive equipment for other work. Either type power unit is easily attached to the press. Adding the unit in no wise affects the famous KRW two-speed hand pumping feature . . . press can still be hand-operated. Study the specification table shown here in terms of your work-pressure and motor needs. Give us the serial number of your KRW press and electric current requirements and we will quote you price and quick-delivery date. Put your idle or infrequently used KRW hand-operated Arbor Presses to work where they will pay big dividends . . . on your production line.



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AVAILABLE TONNAGE PRESSURES

25-50-60 TON PRESSES

AIR PRESSURE	7" AIR CYLINDER		9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder	2" Oil Cylinder	1¾" Oil Cylinder
	10 to 22 Tons	14 to 29 Tons	17 to 35 Tons	23 to 47 Tons

75 TON PRESS

AIR PRESSURE	9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder
	25 to 51 Tons	33 to 68 Tons

KRW Motor Drive develops up to Full Capacity of any KRW Hand-Operated Press.

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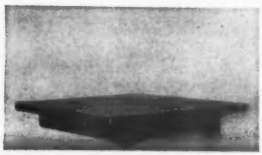
For Laying Out Work on the Bench and Providing a Flat Working Surface



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Accurate to .002" from Flat

SIZES	WEIGHT LBS.	NET PRICES
12 x 12	41	$18.00
10 x 15	45	20.00
12 x 18	60	22.00

ANGLE PLATES

For setting up work on Boring Mills, Milling Machines, Grinders, etc. Also used for Jigs and Fixtures.

Accurate to .002" in 6"

SIZES	WEIGHT		NET PRICES
3 x 3 x 3	4 Lbs.	1 Rib	$ 4.00
4 x 4 x 4	8 Lbs.	1 Rib	4.75
5 x 5 x 5	13 Lbs.	1 Rib	9.25
6 x 6 x 6	17 Lbs.	1 Rib	12.25
8 x 8 x 8	33 Lbs.	2 Ribs	19.25
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12 x 12 x 12	110 Lbs.	2 Ribs	39.50

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This universal set consists of two parallels 1" x 1¾" x 3¾", and two V-blocks 1¾" x 2⅝" x 1⅞". This set has been especially designed for holding various types of work that cannot be placed directly on the magnetic chuck. Complete in Hardwood Case

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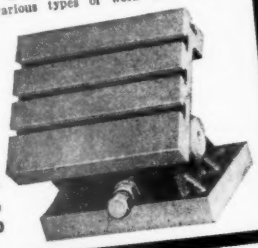
ADJUSTABLE ANGLE PLATES MODEL A ▶

For Machining and Grinding Angles



These Angle Plates are made of the best grade of gray iron, machined and ground true with the holes, all steel parts are hardened and ground. MODEL "A" has four ⅜" "T" SLOTS, 3 on the face side and one "T" Slot on the top when set at 90°. The size of this plate is 3 x 3 x 3¾. Shipping weight 5 lbs.

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BRIEF LOGAN SHAPER SPECIFICATIONS:
Length of ram travel, 7⅜" . . . strokes per minute, "Anyspeed", 64 to 175 . . . length of bearings, main frame, 10" . . . length of ram, 16⅛" . . . width of ram, 5" . . . table traverse, 10½" . . . table vertical travel, 5½" . . . table length, 8" . . . table width, 8" . . . table depth, 1½" . . . saddle bearing, 6" . . . toolhead travel, 2⅜" . . . toolhead swivel, 360° . . . toolhead diameter, 4" . . . Cross feeds, 6 (.002, .004, .006, .008, .010, .012) . . . Sprocket and chain drive . . . vise 5"x5"x1½" . . . motor, ½ hp, 1750 rpm . . . Belts, "A" Belt, V-type . . . floor space, 14"x19" . . . Height over all, 51" . . . Shipping weight, shaper, stand and motor, 535 lbs.

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The Logan Shaper is built by the same organization which engineers and builds the Logan Lathe. With a maximum stroke of 7⅜", the Shaper permits full machining of work 7½" long. It is quickly, easily set up to handle all types of straight cuts, angular cuts, squaring, machining and slotting operations. Metal is removed smoothly and accurately at any desired speed between 64 and 175 strokes per minute. The speed can be changed instantly, without stopping the motor or shifting the belt. The ram is micro-set by a simple screw adjustment. There are six automatic feeds in either direction from .002 to .012, with a half turn of the feed handle in either direction reversing the feed. The tool head may be swiveled 360° and instantly re-set to center by means of tapered locating pins, an exclusive Logan Shaper feature. For ruggedness and lasting accuracy, the Logan 7-inch Shaper is built entirely of steel and cast iron, with no die castings used. The extra heavy cast iron crank plate puts ample power back of every stroke and eliminates chatter. Positive, slip-proof operation, even on heavy cuts, is further assured by the roller type chain drive. For full information on the Logan Shaper, see your Logan dealer, or write direct for catalog information.

N-2

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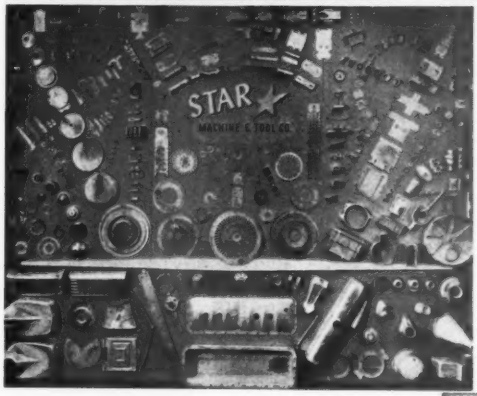

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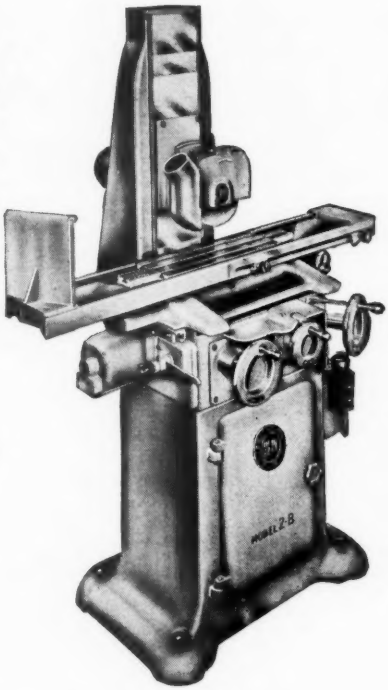

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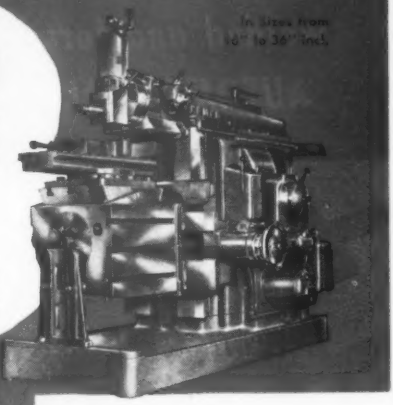
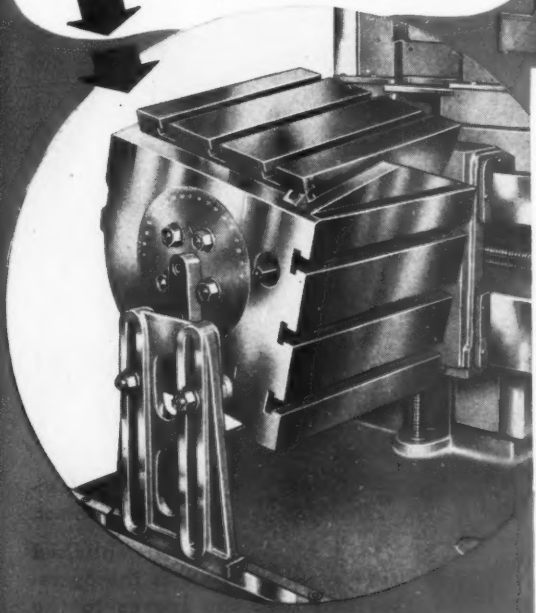
WRITES ONE USER





YES, not only is the Universal Table of GEMCO Shapers *big*, but its usefulness and time-saving qualities are well-known to all GEMCO users. These many users have found that convenience of operation is emphasized by the fact that when table has been brought to desired height and front table support clamped, angular settings may be made in either direction without disturbing front table support. The table may be rotated through full 360 degrees and clamped at any desired point. Also, the tilting top may be positioned and clamped 15° either side of center.

The Universal type of GEMCO Shaper, shown here, is ideal for tool and die work, or where angular setups are required.

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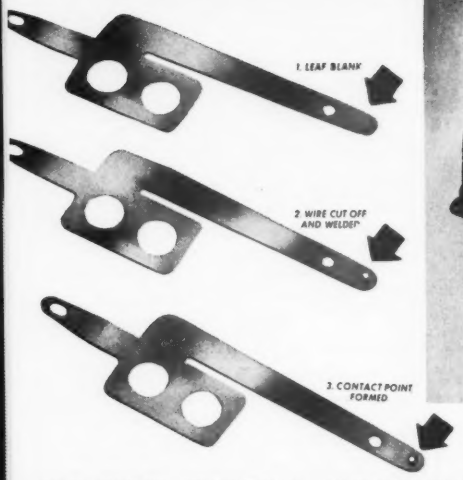

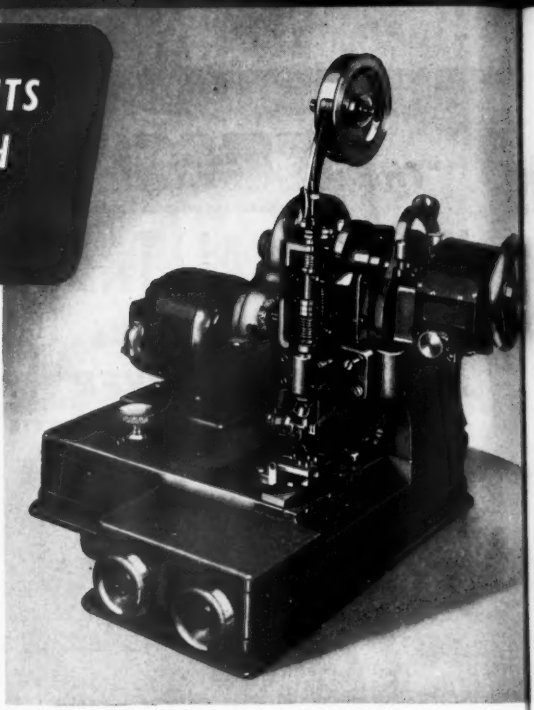

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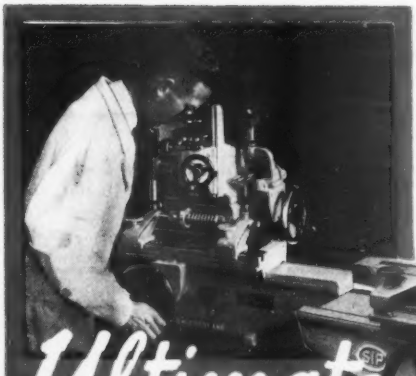

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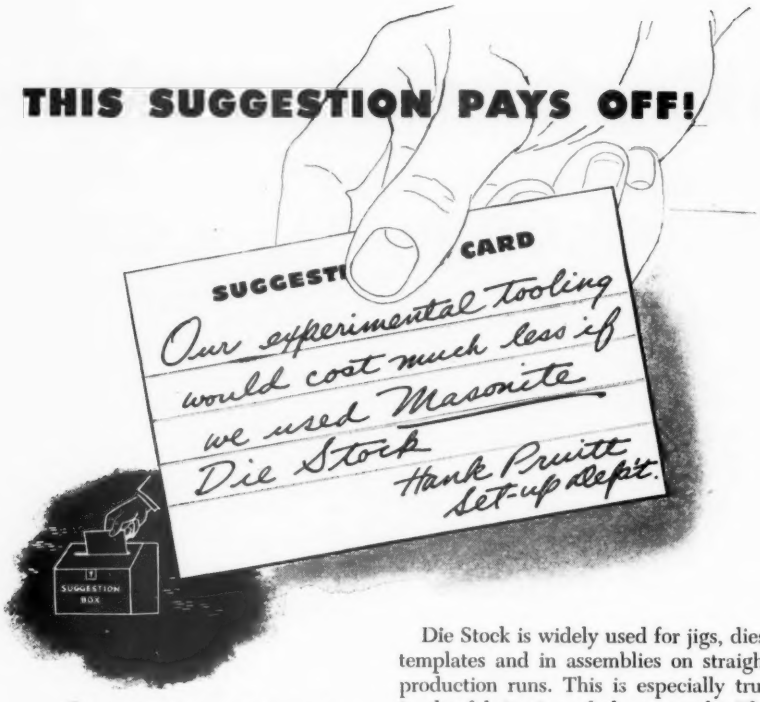
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MACHINE—Gorton Vertical Milling Machine Model 8½-D.

FEED—Hand.

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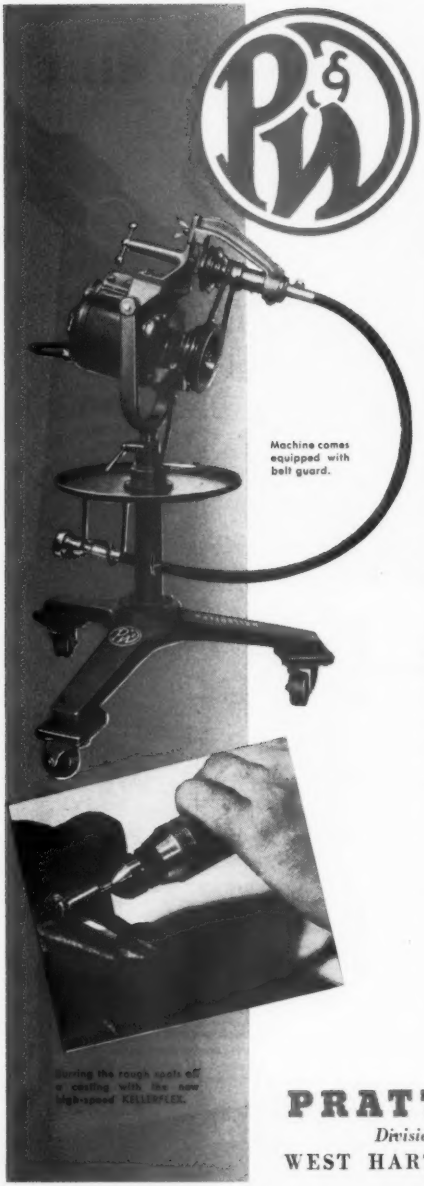

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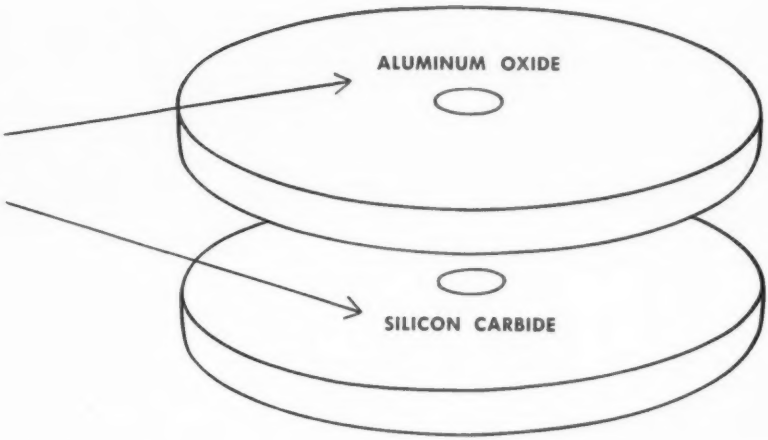

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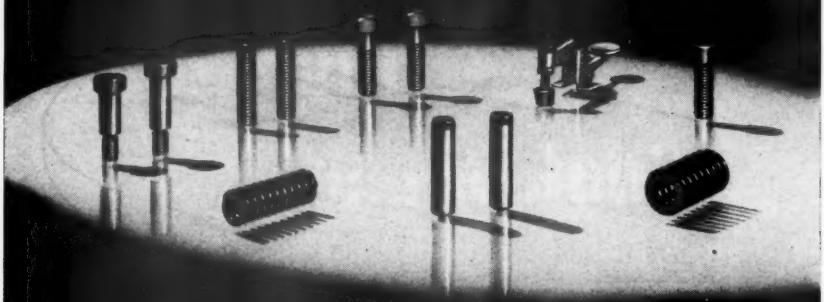

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ROLL-FEED BLANKING OPERATION

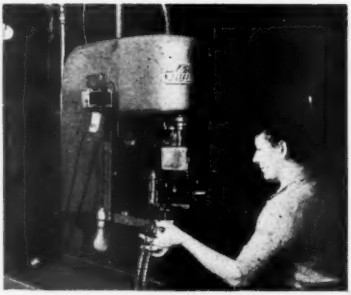
● For the first time in a hydraulic unit, MULTIPRESS brings the kind of ram action you need for efficient, low-pressure, high-speed blanking operations—and adds some typical MULTIPRESS operating advantages in the bargain.

MULTIPRESS, for example, enables you to pre-regulate pressure loads to the exact needs of each operation. Equally important, you can design for progressive operations without having to consider torque losses. You pierce or blank at the same pressure level throughout all stages of step-punch operations—at pressures that do the job perfectly without risk of tool breakage if the metal jams or doubles in the die. And on single-cycle blanking operations MULTIPRESS ends all danger of double strokes.

Users report that this close regulation of pressures gives timely warning when tools are getting too dull for good operation. Also that quick, easy adjustment of ram stroke *length* speeds up job change-overs and gives MULTIPRESS added utility value.

On some operations, it has been indicated that the steady, uniform ram action of the MULTIPRESS gets better, cleaner results. The advantages of this *controlled ram action* shows up even more clearly on secondary drawing and forming operations.

In MULTIPRESS, you have a choice of 4-, 6- and 8-ton capacities, each in seven models, with manual or automatic-cycling controls—plus standard MULTIPRESS tooling and accessories that adapt the basic unit to scores of special operations.



HIGH SPEED LAMINATE BLANKING

The remarkable operating features of this highly compact, self-contained tool are quickly evident in the 4-ton unit. Its ram stroke is fully adjustable from 1/16-inch to 6 inches . . . downward ram pressing range is from 300 to 8000 pounds at 200 ipm; ram return effort up to 5000 pounds . . . it weighs only 725 pounds and measures only 16 x 26 x 34 inches. Write for details on this mighty production midget!

THE DENISON ENGINEERING CO.
1197 DUBLIN ROAD, COLUMBUS 16, OHIO

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BALL BUSHINGS

FOR LINEAR MOTIONS

- **Reduce Wear**
- **Reduce Friction**
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- **Reduce Lubrication**
- **Reduce Maintenance**
- **Reduce Cost of drive motors, gears, linkages, etc.**

The use of ball bearings for rotating parts is unquestionably profitable — a time tested fact! The economies and many other advantages of anti-friction bearings can now be obtained for linear motions.

Free rolling unlimited travel BALL BUSHINGS cannot cock or bind and will maintain almost frictionless precision alignment. Perhaps the size, weight and cost of your entire mechanism can be substantially reduced by application of BALL BUSHINGS.

Investigate their advantages to you! Write for literature containing standard sizes, engineering data and the Twenty Advantages of BALL BUSHINGS.

THOMSON INDUSTRIES, INC.

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FRICTION COSTS MONEY

ROLL IT — DON'T SLIDE IT

SEND for THIS

TO HELP YOUR BORING

Choose an assortment of Bokum Boring Tools—of the sizes you generally use—and let us put them in this sturdy, hardwood, individual box—which we shall furnish without charge. You'll find this a most convenient way to keep these tools together—ready for instant use. The box will hold 8, 10, or 12 tools of your selection in sizes up to No. 3.

You'll prefer Bokum Tools for boring—once you use them—because the clearance angle remains constant through entire life of tool—resharpening never changes form of tool, since only one face is put to grinder—down time for regrinding reduced—finish lapped cutting surfaces produce better bores with faster speeds.

For facing and bottoming, use Style B

For internal threading, use Style C

For general boring, use Style A

Ask for catalog E-1139 for high speed steel—catalog E-398 for carbide tipped

TRADE MARK REG. U. S. PAT. OFF.

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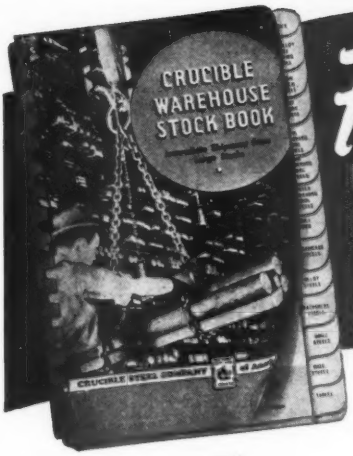
SINGLE POINT BORING TOOLS—INTERNAL THREADING, BOTTOMING AND FACING TOOLS—CARBIDE TIPPED TOOLS



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MACHINERY · TOOL · SPECIAL PURPOSE

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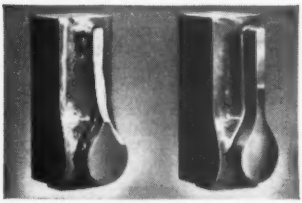
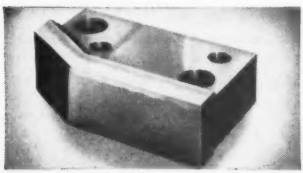
WELDING ELECTRODES

Can Effect Savings in Your Plant!



Die Unit repaired with Eureka Tool and Die Welding Electrodes. No heat treatment required.



Compositely Constructed Die Unit using Eureka Tool and Die Welding Electrodes. No heat treatment required.

You can save many man hours, conserve material and minimize production delays. Tool steel welding can be used profitably in any plant using tools and dies. Here's how it can be done:

1 *REPAIRING DIES* . . . Existing units that may fail in operation can be welded, either partially or wholly, resulting in a minimum of "down-time".

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4 *RECTIFYING ERRORS* . . . Welding permits the correction of errors made in tool and die manufacturing resulting in great savings.

For complete information write for technical catalog

EUREKA ELECTRODES — GOOD STEEL WILL FIND THE WORK

Welding Equipment & Supply Co.

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7″ SHAPER

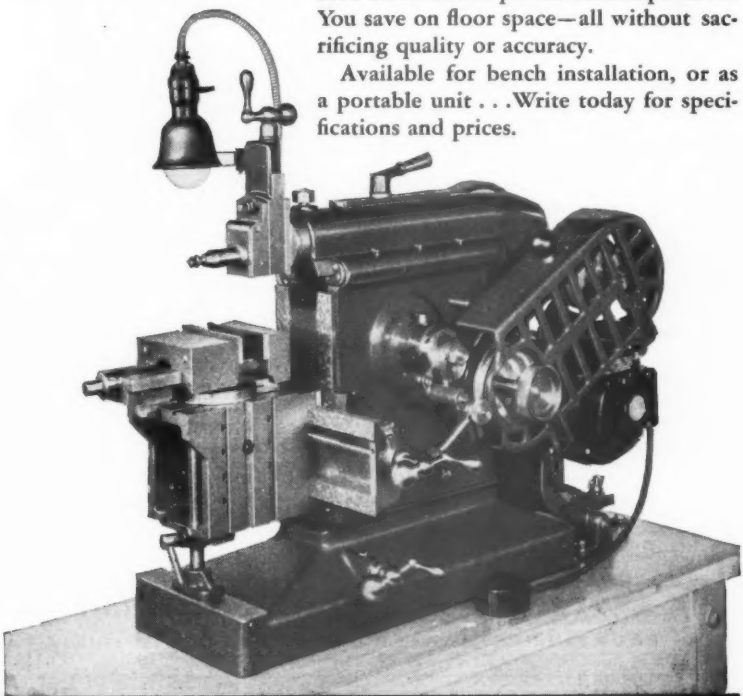
--A precision machine

meets postwar needs for accuracy, speed and economy

If your production costs are going up, and your profit margin is getting less and less (and whose isn't)—consider what the Ammco 7″ Shaper can do for you.

The accuracy of work turned out on an Ammco 7″ Shaper assures precision production unsurpassed by larger machines selling for hundreds of dollars more than the Ammco . . . In addition to low initial cost, you also effect big savings in time and expense on set-up operations . . . You save on electrical power consumption . . . You save on floor space—all without sacrificing quality or accuracy.

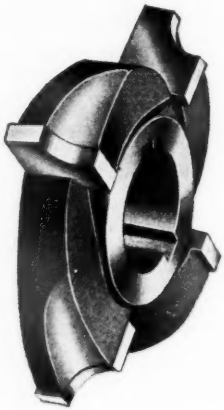
Available for bench installation, or as a portable unit . . . Write today for specifications and prices.



AMMCO 2100 COMMONWEALTH AVENUE NORTH CHICAGO, ILLINOIS

STEP UP PRODUCTION 500%

With Meyers Carbide Tipped Formed Tools



On actual production runs, Meyers generated Carbide Tipped Tools have boosted production more than 500%.

This amazing increase was due to use of special Meyers equipment designed and engineered by our Engineering Department. Increased costs force you to get the most out of your machine tools—Meyers generated carbide tipped form tools will give you more pieces per hour—more pieces between grinds—and a much smoother finish. Let us help you improve your production and cut your costs. Send us your prints for quotation.

W. F. MEYERS COMPANY, INC. • *ESTABLISHED 1888*

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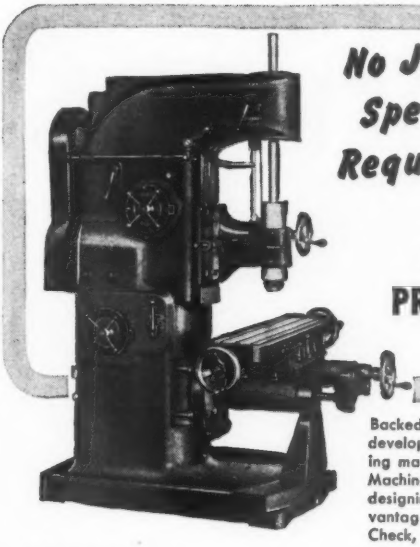

No Jigs or Special Fixtures Required with a . . .

KNIGHT MILLING AND PRECISION BORING MACHINE

Backed by 35 years of experience gained in the development and manufacture of specialized milling machines, Knight Milling and Precision Boring Machines have built into them, through skillful designing and craftsmanship, qualities and advantages that effect important production savings. Check, for instance, these profit-making features:

FLEXIBILITY . . . *An exclusive swiveling, tilting table increases productive time by eliminating special setups and expensive jigs and fixtures. Knight Millers do jobs that ordinarily would require two or more single-purpose machines.*

CAPACITY . . . *Sixteen changes in spindle and table speeds, four changes in vertical spindle feeds, plus the table flexibility, all combine to furnish increased working area and capacity.*

SPEED . . . *Substantial time savings are gained by reduced setup time, elimination of special setups, quickly adjustable spindle and easy-to-read dial indicators.*

RUGGEDNESS . . . *The one-piece backbone-and-base semi-steel, heavily reinforced column casting, combined with engineered precision in all moving parts, provides unusual sturdiness.*

EASE OF OPERATION . . . *Simplicity of operation, handy, clear vision controls for direction, speeds and feeds, all contribute to fast, efficient performance.*

Knight Milling and Precision Boring Machines can help you achieve substantial savings in time, labor and equipment costs.

Write for Details Today!

KNIGHT VERSATILE ACCURATE RIGID MILLERS

W. B. KNIGHT MACHINERY COMPANY

MORE GOODS for MORE PEOPLE at LOWER COST

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Save production time with a SHOPLIFTER

- **Light, Compact**
- **Easily Moved About**
- **One-Man Operated**
- **Wide Range in Application**
- **Saves Production Time**
  in handling dies and heavy fixtures; stacking barrels, boxes, etc.; loading and unloading trucks

Specifications

Type—D
Capacity—500 lbs.
Overall height—72"
Platform lift—54" above floor level, lowers to within 5" of floor
Baseframe—24" wide x 33" long
Platform—24" x 24", steel plate
Entire frame of machine of structural steel, electrically arc welded throughout
Basewheels—4" diameter, iron wheels
Crank up and down hoist unit
Two swivel casters and two stationary wheels with push bar furnished
Painted olive green finish
Weight—250 lbs. (approx.)

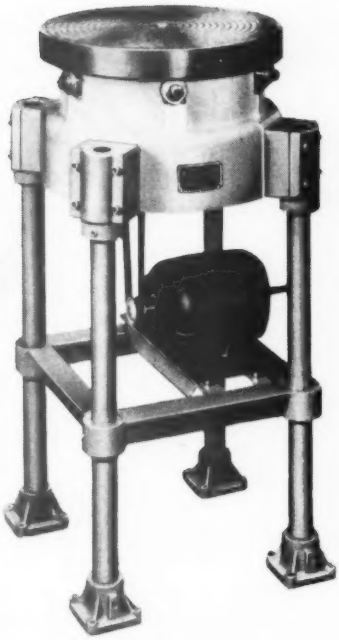
Heavier capacities up to 5,000 lbs. also available. Write for details.

Prompt Delivery . . . Price* $157.50. *Full freight allowed

Foot Operated Floor Lock—$10.00 extra

ECONOMY ENGINEERING CO., 2659 W. Van Buren St., Chicago 12, Illinois

NEW- low cost precision flat lapping



A new low cost machine for high speed precision flat lapping of single jobs or production runs of steel, quartz, glass and other materials. It finishes each piece to a high polish and precision flat finish and size. Single pieces require no holders, chucks or collets . . . the operator directs the work on the revolving lapping plate. Production lapping of small parts is done by use of standard or special holders.

Check these advantages:

- High quality precision results
- High production at low cost
- Compactness
- Low first cost
- Simplicity and ease of operation
- Speed and economy of operation
- Minimum maintenance

A Few of its Many Uses:

Precision flat lapping of

- Air-tight or liquid-tight seals
- Flat surfaces on plastic molds
- Flat surfaces on die casting molds
- Machine or tool parts
- Flat sliding surfaces
- Flat rotating surfaces

Special lapping plates are available at low cost. These plates are easily put on or taken off machine without tools.

This New SPITFIRE PRECISION FLAT LAPPING MACHINE is precision built . . . all gears and bearings are factory sealed in lubricant. The lapping plate revolves on sealed and greased-for-life ball bearings.

Write Today for Further Details and Prices

SPITFIRE

TOOLS, INC.

2931 N. Pulaski Rd. Chicago 41, Illinois

FREE ENGINEERING SERVICE

Send in your parts and/or blueprints and our engineers will gladly make an engineering analysis, without any charge or obligation, of the lapping or polishing operations possible on the SPITFIRE PRECISION FLAT LAPPING MACHINE.

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Gentlemen:

Please send me further details and prices on your New SPITFIRE PRECISION FLAT LAPPING MACHINE, without charge or obligation to me.

Name.....Position.....

Company.....

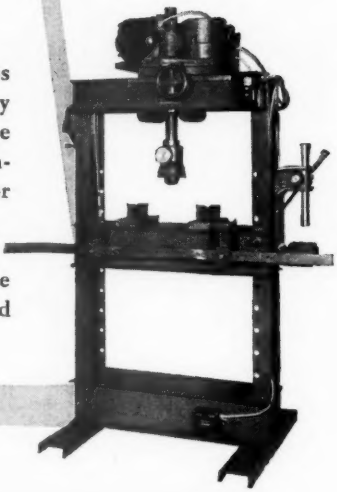
Address.....

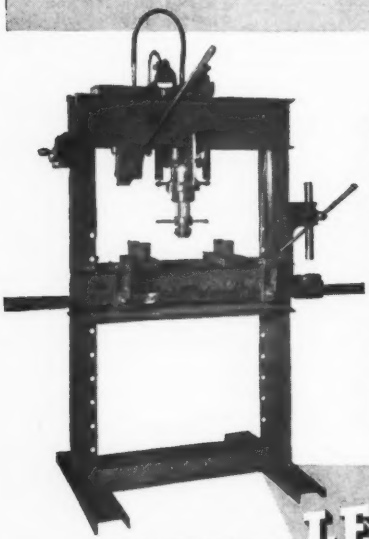
City.....State.....

Save Time.. Save Labor

WITH LEMPCO PRESSUREMATIC PRESSES

Lempco Pressurematic Presses will pay for themselves many times in your shop. They can be used for press fitting, assembling, bending, straightening or die tryouts. Pressurematic Presses are made in Electric and Hydraulic models. Pick the one that fits your needs and place your order today.





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Speed . . . power . . . economy . . . make the Lempco Electric Press the outstanding machine of its kind. Available in 20, 40 and 60 ton models. Foot controls free operator's hands for any operation. Builds up from zero to 60 tons in just 4 seconds. Automatic Pressure Control available for this press. Prevents excessive pressure which might damage work. And it also permits press to be used for production runs.

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Two pumping speeds . . . adjustable work head on 60-ton model for easy centering over work . . . long ram travel . . . and other fine features make the Lempco Hydraulic Press the most efficient hand-operated press on the market. Made in 40 and 60 ton models.

LEMPCO

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Write for free book *that tells how, when and where Lempco Pressurematic Presses can be used to your greatest advantage.*

INCREASE PRODUCTION

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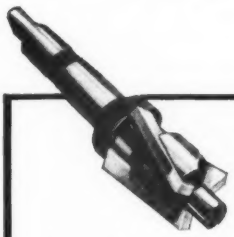
ADJUSTABLE HOLLOW MILLS



Other Genesee tools that will increase production.

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Inserted Blade FACING AND COUNTERBORING TOOLS

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SPECIAL PRODUCTION TOOLS

There is a Genesee for every hollow milling job. Available in 16 styles. Standard sizes from 0 to 2″, with straight or Morse taper shanks carried in stock . . .

- Each size tool has 1/8 range.
- Blades quickly ground in a simple fixture.
- All tools manufactured of heat-treated alloy steel.
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- Furnished with high speed steel, cast-alloy, or Tungsten Carbide tipped blades.

Let our Engineering Department solve your Production Tool problems.

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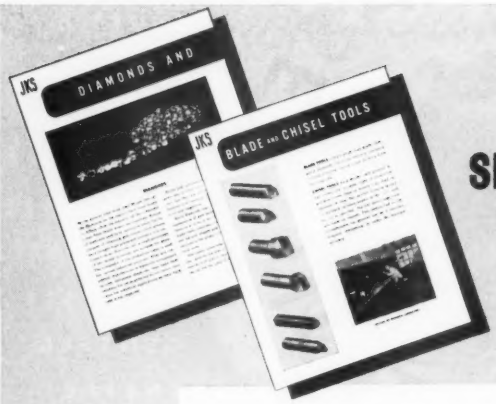
ADJUSTABLE HOLLOW MILLS • FACING AND COUNTERBORING TOOLS • SPECIAL PRODUCTION TOOLS



SHOWS ALL... TELLS ALL

NEW JKS INDUSTRIAL DIAMOND TOOL CATALOG

With pictures, diagrams, figures and facts, the new JKS Industrial Diamond Tool Catalog is off the press and ready to show you how to get maximum results from diamond tools . . . why they are piling up savings in time and money for so many types of industry today.

This 64-page plastic bound catalog offers you interesting and helpful information on diamonds themselves and all types of JKS industrial diamond tools. Twenty pages are devoted to JKS Standard Tools, adaptable to 73 different makes of machines . . . listed by the equipment manufacturers' name. Send for your free copy of this useful catalog on your company letterhead today.

J. K. SMIT & SONS, Inc.

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ROCKFORD
Hy-Draulic
MACHINE TOOLS

Over sixteen years ago the Rockford Machine Tool Co. introduced the first hydraulic reciprocating machine tool. Today our belief in the superiority of hydraulic design stands justified, for Rockford Hy-Draulic Machine Tools have proved themselves wherever and however employed. The exclusive and highly specialized engineering experience that has been ours is fully applied in each machine tool we build.

Every Rockford Hy-Draulic Machine Tool offers such important fundamental advantages as:

1. Ease of control for quick set-up and fast operation.
2. Stepless Speeds . . . infinitely adjustable throughout a wide specified range. Hy-Draulic tool-head feeds similarly adjustable.
3. Efficient, smooth hydraulic pressure . . . maintains cutting speed as set, no matter how work resistances may vary.
4. Smooth, fast reversals and high return-stroke ratios. Oil flow through Hy-Draulic System is instantly reversible. Simplicity of Hy-Draulic System holds inertia factors to a minimum.
5. Fine finish and long tool life. Smoothness of Hy-Draulic drive, free of mechanical play and vibration, protects work and cutter.

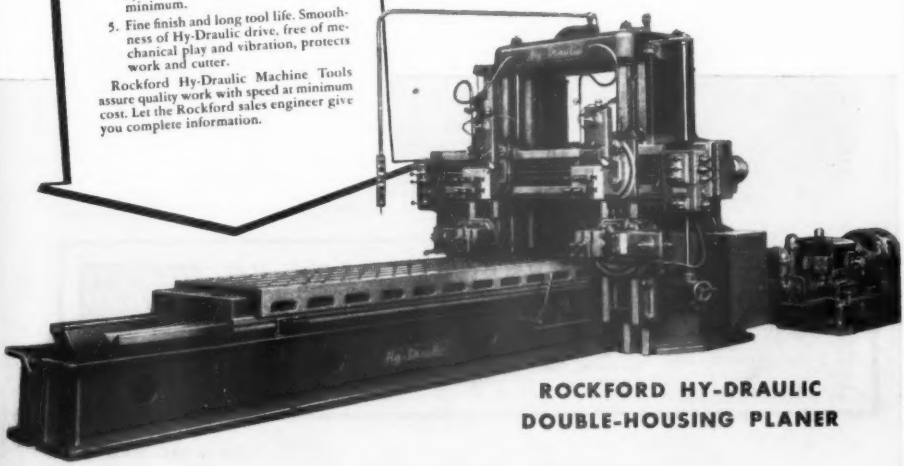
Rockford Hy-Draulic Machine Tools assure quality work with speed at minimum cost. Let the Rockford sales engineer give you complete information.

low bridge

With the cross rail snuggling the top brace, this Rockford 48"x48" Hy-Draulic Double-Housing Planer is handling a 46" high, five ton casting with speed, ease and accuracy. On the particular job shown, set-ups require stroke lengths of as little as 8", with the tool heads feeding across the entire width of the casting. Hy-Draulic drive can take work like that in stride without sacrifice of speed in either cutting stroke or reversal. Rigidity of Rockford Planer construction is also demonstrated here; work is smooth and accurate although the cross rail is raised to near-top position.

Rockford Hy-Draulic Double-Housing Planers are built in four standard sizes, from 36"x36" to 60"x60", each size is available in six maximum stroke-length ratings ranging from 10 feet to 20 feet. You are invited to write for complete information on these machines. Ask for Bulletin **2521**

ROCKFORD MACHINE TOOL CO.
ROCKFORD, ILLINOIS
Hy-Draulic
SHAPERS-PLANERS-SLOTTERS-SHAPER-PLANERS



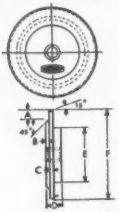
ROCKFORD HY-DRAULIC
DOUBLE-HOUSING PLANER

UP TO 500% **MASTERFORM** MASTERCASED STEELS LONGER LIFE

GROUND CIRCULAR CUT-OFF TOOLS

FOR BROWN AND SHARPE Screw Machines. Made in special-to-order and stock sizes (see below), ready for prompt shipments.

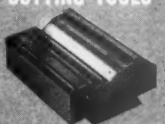
Masterform cut-off tools are made from specially selected high speed steel, carefully hardened and ground to a high polish. Mastercasing, the Masterform process of super-heat-treating, assures more production and 500% LONGER LIFE.



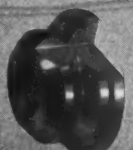
Designed to cut off .005 past center with 1/64 corner break.

ORDER BY CAT. NO	FOR USE ON MACHINE NO.	STOCK DIA.	A	B	C	D	E	F	PRICE EACH
00-30	00	1/16	.029	1/16	.030	1/4	1 27/64	1.750	4.00
00-40	00	1/8	.0635	1/16	.040	1/4	1 23/64	1.750	4.00
00-50	00	3/16	.0975	1/16	.050	1/4	1 19/64	1.750	4.00
00-60	00	1/4	.131	1/16	.060	1/4	1 19/64	1.750	4.00
00-80	00	3/8	.1985	1/16	.080	1/4	1 15/16	1.750	4.00
0-60	0	3/8	.1935	3/32	.060	5/16	1 5/8	2.250	4.50
0-80	0	1/2	.261	3/32	.080	5/16	1 5/8	2.250	4.50
0-90	0	5/8	.3265	3/32	.090	5/16	1 5/8	2.250	4.50
2-60	2	3/8	.1935	1/8	.060	3/8	2 7/32	3.000	5.60
2-90	2	5/8	.3265	1/8	.090	3/8	2 7/32	3.000	5.60
2-125	2	1	.5234	3/32	.125	3/8	1 29/32	3.000	5.60
2-156	2	1	.5318	3/32	.156	3/8	1 29/32	3.000	5.60

LOOK TO MASTERFORM FOR BOTH STOCK SIZES AND *Special* TO ORDER CUTTING TOOLS



DOVETAIL FORMING TOOL



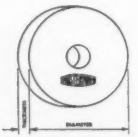
CIRCULAR FORMING TOOL

HIGH SPEED CIRCULAR TOOL BLANKS

FOR FORMING AND CUTTING-OFF TOOL USE

Made from a selected grade high speed steel, these tools are for use on circular cross slide tool posts of Brown & Sharpe automatic screw machines. These blanks are turned, drilled and tapped to fit tool post clamping screws. Blanks are either furnished soft as machined, or hardened and ground on two sides.

When ordering, please specify whether hard or soft blanks are desired, also diameter or machine number and thickness. Carried in stock for prompt shipment.



Tool blanks for other makes of screw machines can be furnished on special order.

FOR MACHINE NUMBER	DIA. INCHES	THICKNESS INCHES	NET PRICES SOFT BLANKS 1-6	NET PRICES SOFT BLANKS 7-12	NET PRICES HARD BLANKS 1-6	NET PRICES HARD BLANKS 7-12
00,000,19 AUTO	1 3/4	1/4 to 3/8 by 16ths	1.15	1.10	1.48	1.41
00,000,19 AUTO	1 3/4	7/16 to 5/8 by 16ths	1.35	1.30	1.71	1.65
00,000,19 AUTO	1 3/4	11/16 to 7/8 by 16ths	1.75	1.70	2.20	2.15
00,000,19 AUTO	1 3/4	15/16 to 1 by 16ths	1.80	1.75	2.25	2.20
0 and 00 AUTO	2 1/4	1/4 to 3/8 by 16ths	1.30	1.25	1.67	1.61
0 and 00 AUTO	2 1/4	7/16 to 5/8 by 16ths	1.75	1.70	2.22	2.15
0 and 00 AUTO	2 1/4	11/16 to 7/8 by 16ths	2.15	2.10	2.75	2.68
0 and 00 AUTO	2 1/4	15/16 to 1 1/8 by 16ths	2.45	2.40	3.18	3.10
2 and 2G AUTO	3	1/4 to 3/8 by 16ths	1.80	1.75	2.24	2.17
2 and 2G AUTO	3	7/16 to 5/8 by 16ths	2.50	2.45	3.14	3.06
2 and 2G AUTO	3	11/16 to 7/8 by 16ths	3.15	3.10	4.00	3.92
2 and 2G AUTO	3	15/16 to 1 1/4 by 16ths	3.65	3.60	4.65	4.57

LARGER AND SPECIAL SIZES FURNISHED ON SPECIAL ORDER
UNLESS OTHERWISE SPECIFIED, SOFT BLANKS WILL BE FURNISHED

MASTERFORM TOOL CO.

2552 IRVING PARK ROAD • CHICAGO 18, ILL.

Manufacturer and Designer of

Circular, Dovetail and Flat Forming Tools
Counterbores
Cut-Off Tools
Recessing Tools
Reamers
Forming Tool Blanks
Cast Metal Alloy Tool Bits & Associated Products

ORDER FROM OUR FACTORY REPRESENTATIVE (There's one near you) OR FROM US

LUCIFER

ELECTRIC HEAT • • • • •
TREATING FURNACES • •
with automatic control . .

These furnaces will answer your heat treating problems for hardening, drawing, tempering and annealing or normalizing of dies, punches, gage and fixture parts—in fact anything that will fit within our range of muffle sizes. They are quiet and efficient and do not use up the oxygen in your heat treating room. The Lucifer Automatic Heat Control permits stepless control anywhere within its heat range—up to 2000° F.

The Cabinet is fabricated of cold rolled steel and attractively finished in baked wrinkled enamel, and the insulation is not skimped, hence you have a very small heat loss.

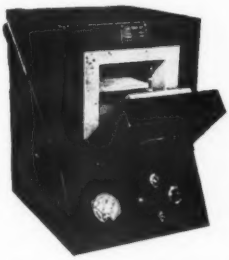
You can now equip your old furnace with a Lucifer Automatic Heat Control unit 110 or 220 V.A.C. up to 5 K.W., from $27.50 to $41.50 complete.

We can also supply a 7-day Control, which will turn your Furnace on in the morning and off at night, shut off at noon Saturday, skip Sunday and repeat each 7 days. $27.50 complete.

All prices are F.O.B. factory—Philadelphia, Pa.

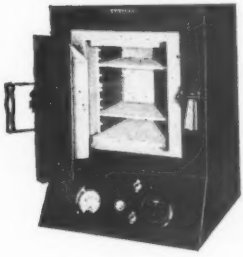
$112.00

- Interior size—Model 7051 5½" x 5½" x 8"
- Exterior size— 15" x 15" x 17"
- Operation— 110 V.A.C. only
- Rating—1.2 K.W.
- Ship. Wt.— Approx. 85 lbs.



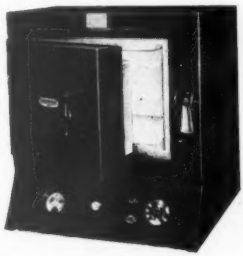
$188.00

- Interior size—Model 7053 8" x 8" x 10"
- Exterior size— 18" x 20" x 24"
- Operation—110 V.A.C. or 220 V.A.C.
- Rating—3 K.W.
- Ship. Wt.— Approx. 225 lbs.



$260.00

- Interior size—Model 7052 12" x 12" x 10"
- Exterior size— 22" x 22" x 24"
- Operation—220 V.A.C.
- Rating—4.8 K.W.
- Ship. Wt.— Approx. 350 lbs.



New York—Connecticut—Northern Jersey: Lafayette Tool & Supply Co., 128 Lafayette St., New York 13, N. Y.

Rhode Island—Massachusetts: H. Leach Machinery Co., 387 Charles St., Providence 4, R. I.

Eastern Pennsylvania—Southern Jersey: Wilson Steel & Tool Co., Commercial Trust Bldg., Philadelphia 2, Pa.

California: Reagan Company, 6409 Santa Fe Ave., Huntington Park, Calif.

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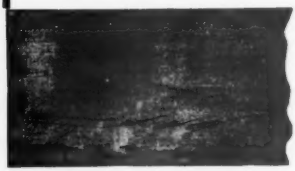
What is DIE-LESS DUPLICATING?

Here is a simple 3-STAGE explanation:

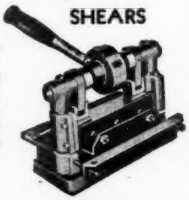
"DIE-LESS DUPLICATING" might be described as a new industrial technique made possible by the accuracy, extreme adaptability and ease of operation of DI-ACRO Precision Machines—Shears, Brakes, Benders —especially when used as a continuous, integrated production process.



←1ST STAGE . . .

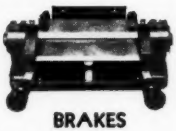
Cutting flat material to size and shape for part to be duplicated. The DI-ACRO shear rapidly resizes and squares material, also makes slits, strips, notches, angle cuts, etc. Guides, stops and blade pitch are all quickly adjustable. 3 sizes—shearing widths 6", 9", 12".

SHEARS



←2ND STAGE . . .

Forming angles, channels or "Vees" from sheared flat material. The DI-ACRO Brake forms any angle from 0° to a maximum of 110°. Contact surfaces are adjustable and may be slotted, recessed or altered as needed for the parts required. 3 sizes—folding widths, 6", 12", 18".



BRAKES

←3RD STAGE . . .

Bending sized and formed material to simple, compound or reverse curves of desired radii. The DI-ACRO Bender handles angle, channel, moulding, rod, tubing, wire (round, square, flat), strip stock and other ductile materials in a remarkably wide range of accurate contour forming. 3 sizes—radius capacity 3", 6", 9", handling up to ¼" cold rolled steel bar.

BENDERS

DO YOU HAVE DUPLICATE PARTS TO FORM? . . . .

The DI-ACRO System of METAL DUPLICATING WITHOUT DIES has proven its adaptability in making parts just as accurately as can be done with dies, to a tolerance of .001" in all duplicated work. The delay of waiting for dies is avoided—deliveries speeded up. Changes needed in production can be made simply by adjustment of DI-ACRO Precision Machines, which are also widely used for laboratory and research work, making models, etc. Production work is often done in excess of 1,000 operations per hour, by girls or inexperienced workers.

Send for Catalog—
"DIE-LESS" DUPLICATING

It gives full details on all models of DI-ACRO Shears, Brakes, Benders, and many examples of parts made with "DIE-LESS DUPLICATING".

←Pronounced "DIE-ACK-RO"

DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.

315 EIGHTH AVE. SOUTH MINNEAPOLIS 15, MINNESOTA

QUIT Making Manual CLAMPING ADJUSTMENTS!

Let the Pressure-Matic Assembly provide automatic compensation for thickness variations in parts being clamped

There may be variations up to ¼ inch in the thickness of work being held—castings, forgings, wood and plastic parts. With a Pressure-Matic Assembly welded to the working bar of your De-Sta-Co Clamp, compensation for each variation becomes automatic. A heavy compression die spring allows the spindle to adjust itself to the thickness of material, always maintaining positive holding pressure. Available in two types, for installation on De-Sta-Co medium and heavy duty Clamps.

SEND FOR the new De-Sta-Co Catalog No. 45. Fully describes the Pressure-Matic Assembly, also complete line of time-saving Clamps.

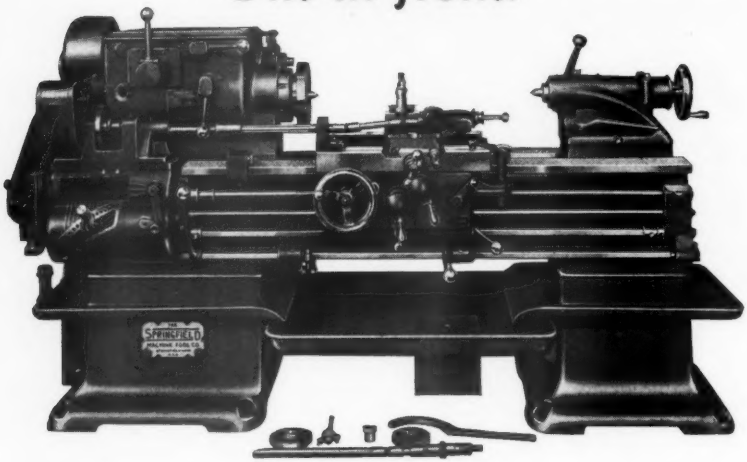
DETROIT STAMPING CO.

Established Over 30 Years

344 Midland Ave • Detroit 3, Mich.

SPRINGFIELD PRECISION LATHE

Out in front!



● Headstock . . . twelve speeds . . . only half of the easy-shifting spur gears mesh at one time.

Motors . . . V-Belt or silent chain drive.
Bed . . . permanently true—made of high test alloy to resist warp or marring under severe service.

Apron . . . extra heavy—operates on Ball and Bronze bearings throughout.
Taper attachment . . . hair-trigger adjustment.

Compound rest . . . sturdy, firm.
Tailstock . . . all bearings and bed ways oiled from one well.

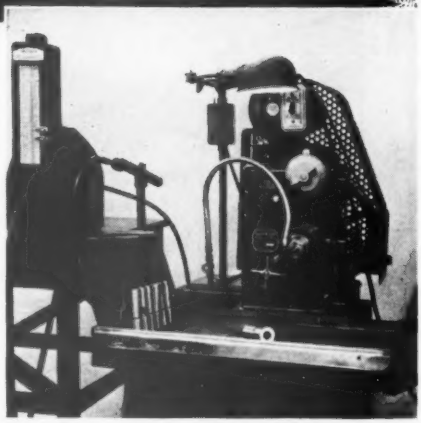
From headstock to tailstock—the SPRINGFIELD Lathe is *out in front!*

SEND TODAY FOR BULLETIN No. 163

Tells the why and how of Springfield's accurate production.

THE SPRINGFIELD MACHINE TOOL CO.
SPRINGFIELD • OHIO, U. S. A.

In One Minute — You Can Set Up the SUNNEN Precision Honing Machine to Handle Any Diameter From .125" to 2.625"



The Sunnen Precision Honing Machine can be changed from one job to another with very little set-up time. Ideal for either short or long runs.

The Sunnen Precision Honing Machine is being used to advantage on production runs as well as in tool rooms, salvage and maintenance work, where job requirements change from hour to hour. Accuracy within .0001", surface finishes as fine as the job requires.

Here are some other things this machine will do for you:

Produce a straight, round hole every time; eliminate bell-mouth, taper, and "rainbow" condition; correct errors of previous machine operations; align two holes of the same diameter — without skilled help or expensive equipment, and at low operating cost.

The Sunnen Precision Honing Machine produces work that regularly passes inspection gauged by the most modern scientific instruments—as shown above.

Write today for complete details — or have a Sunnen Engineer come in to show you what this honing machine can do on your jobs — in your plant.

SUNNEN PRODUCTS COMPANY

7947 Manchester Ave. • St. Louis 17, Mo.

Canadian Factory: Chatham, Ontario

SUNNEN

Typical Jobs

Aircraft Hydraulic Brake Cylinder. Honing 3 times faster than lapping—and gave a straighter hole.

Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.

Aircraft Carbureter Operating Valve Sleeve. Sunnen honing eliminates distortion from assembling operation.

Hydraulic Control Bushing. Honing gives straight round hole after rough reaming.

Aircraft Piston Pin. Sunnen honing is twice as fast and gives a cleaner, better looking pin.

ALLEN Socket Head Cap Screws

ALLEN HEAD used as jig and fixture feet

Ready-at-hand for the toolmaker's use, — all ready-made except for grinding for squareness, as required in using any other type of feet on jigs or fixtures. Save the time *and* expense of making *special* feet.

Allen Socket Head Cap Screws have the hardness for long wear, but not a degree of hardness subject to cracking. Being replaceable — as special feet often are not — they can be dressed at trifling cost as compared with expense of repairing cracked or broken feet. Handiest, cheapest safeguards against tie-ups in high-production work. . . Available in *standard sizes* for jig and fixture feet, as well as for all general tool and die work. Ask your local Allen Distributor to fill out your stock for this special use.

THE ALLEN MANUFACTURING COMPANY
HARTFORD 1, ★ ALLEN ★ CONNECTICUT, U. S. A.

IT'S A GREAT HACK SAW BLADE

THIS MILFORD FLEXIBLE REZISTOR!

SAFE...

Replaces all hard blades for all users . . . skilled or unskilled

ECONOMICAL...

Delivers full cutting life . . . no accidental breakage

- **Cannot break or shatter in the frame.**
- **Faster and greater production per blade.**
- **Made from a new high-speed steel for longer cutting life. Only the teeth are hardened . . . the back is tough and flexible.**

Plus

"EASY-STARTING TEETH" IN ALL HAND SIZES . . . EXCLUSIVELY MILFORD.

Order from your mill supply distributor. He is always ready to serve your needs for all factory and mill supplies, as well as Milford hack saw and band saw blades.

MILFORD FLEXIBLE REZISTOR is the answer to your HACK SAW cutting problems

MILFORD
PROFILE AND BAND SAW BLADES
REZISTOR AND DUPLEX HACK SAW BLADES

THE HENRY G. THOMPSON & SON CO.
Saw Specialists Exclusively for Over 65 Years
NEW HAVEN 5, CONNECTICUT, U. S. A.

HEAT TREAT SMALL PARTS

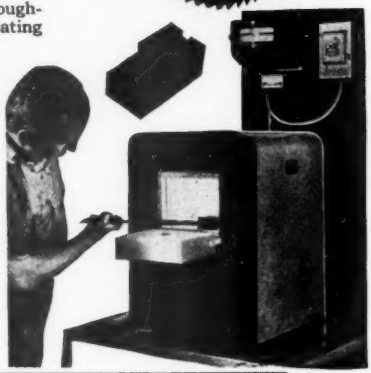
In Your Own Plant

ESSENTIAL FOR TOOL AND DIE SHOPS

You save time and money heat treating small tools and dies in a Cooley Electric Furnace. Uniform temperatures are maintained throughout the furnace chamber to assure even heating of parts. The heating elements are embedded in refractory materials, protecting against atmospheric attack. They are easily replaceable.

ECONOMICAL TO OPERATE

To hold 1600° F. in the MH-3 furnace requires less than 2 kw. At power rate of 2c per kw.-hr., operating cost is under 4c per hour. The MH-4 furnace requires less than 2.5 kw. or under 5c per hour at the same rate. Cooley Furnaces are easily installed—ready for immediate service by connecting power lines to two terminals. Quiet in operation—no fumes or odors—no ventilating necessary—they can be located at any convenient place in the shop.



More Profitable Reasons for Using Cooley Furnaces

1—Hardening, drawing and tempering small batches in large furnaces is uneconomical.

2—Small parts can be normalized and annealed quickly and easily.

3—Convenient for pre-heating prior to high-speed hardening.

4—Always available to handle emergency repair work without delay.

5—Use as a pilot furnace to predetermine techniques for production heat treating.

TWO NEW OPTIONAL FEATURES AVAILABLE

1. Vertical Lift Door — Counter weighted for ease of operation—conserves heat where door need not be fully opened to enter or remove work. Supplied in place of standard hinged hearth door at $20.00 additional to regular furnace prices shown below.

2. Heavy Gauge Steel Stand — For ease of installation and operation—locates furnace at most convenient operating height and provides additional working and storage space. Add $35.00 to regular furnace prices shown below.

AVAILABLE IN TWO SIZES

Type	Chamber Capacity	Amps 115 V	Watts	Amps 230 V	Price
MH-3	8"W 6"H 14"L	29.6	3400	14.8	$146.00*
MH-4	10"W 6"H 18"L	.....	4800	20.9	$222.50*

*Includes Hearth Plate

MAX. SAFE TEMPERATURE — Continuous operation, 1750° F.; Intermittent operation, 1850° F.

AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire—approximately $150.00.

NO SALESMEN WILL CALL

Ask for free information and ordering instructions so you can make your own decision and determine your own requirements. Write for Bulletin No. 50 today—no obligation.

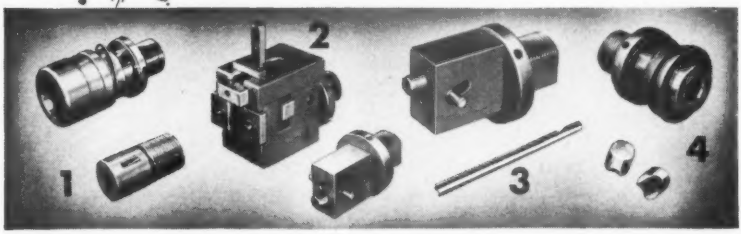
COOLEY ELECTRIC MANUFACTURING CORP.
32 South Shelby Street Indianapolis 7, Indiana
INDIANAPOLIS MACHINERY EXPORT CORP
Export Manager, 44 Whitehall Street, New York, New York

BROACHING *is One Business Where You Need* "PULL"

Be Sure You Have The Right *American* Broach Pull Head

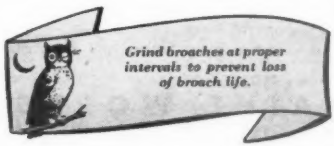
TO GIVE your broaches and broaching machines a maximum degree of operating time, you need quick-connecting broach pull heads. *American* offers a complete line of pull heads—the *right* head for every broaching operation. Each *American* model is designed with a particular purpose in mind. All are engineered and built by broaching experts.

To help you get the most from your broaching equipment, *American* has published an illustrated booklet on broach pull heads and their uses. Write for free copy. It is part of *American's* complete broaching service—machines, tools, and engineering.



Four types of *American* Broach Pull Heads are illustrated. (1) Automatic 4-Jaw Type Puller for horizontal or pull up use. A similar model, with chip shield, is made for pull down use. Standard sizes for shanks from ¼" to 3½" diameter. (2) Automatic Keyway Broach Pull Head for use with keyway square, rectangular, and oval broaches. Broach is rigidly held in proper alignment. Set of adapters permits using old style threaded keyway broaches with this head. (3) Automatic Pin Type Puller for use with broaches having shanks ½" in diameter or smaller. Holds shank by means of a half-round groove cut across the pulling end. Automatically provides positive radial positioning. (4) Type "V" Quick-Change Broach Puller for use with broaches having old style threaded shank. The two-piece jaws are quickly and easily removed while head is in machine. Eliminates necessity of screwing broach into place. Replaceable jaws furnished for all sizes of threads up to 1" diameter.

Slotted type broach pullers and ordinary threaded broach pullers, not illustrated, are also available.



MEMBER BROACHING TOOL INSTITUTE

American BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

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SPECIAL MACHINERY

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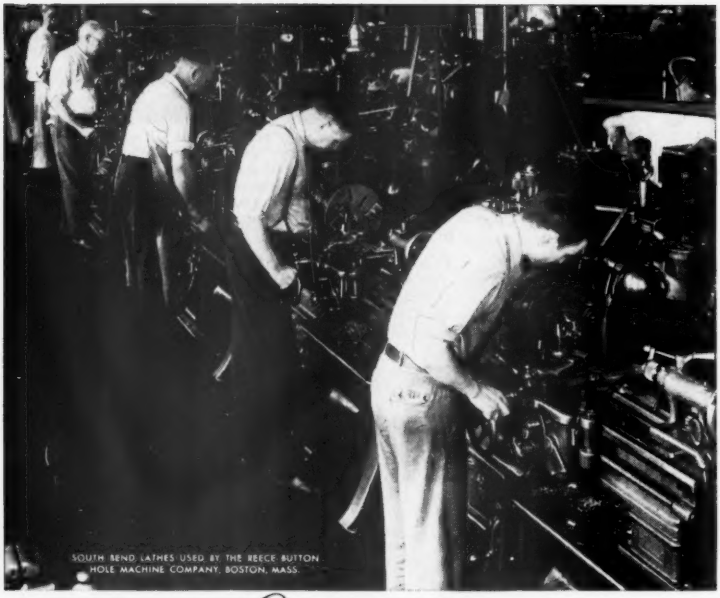


SOUTH BEND LATHES USED BY THE REECE BUTTON-HOLE MACHINE COMPANY, BOSTON, MASS.

SOUTH BEND LATHES

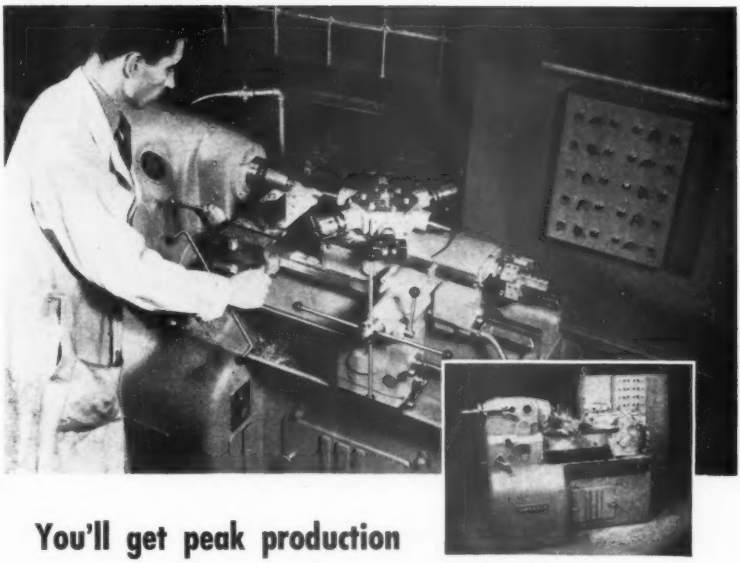
Speed the Flow of Production

Time saved in machining operations helps speed the flow of production, reduces manufacturing costs, and increases profits. A few seconds cut from each operation are highly important. Machine tools that are easy to operate, that can handle a wide variety of operations, consistently produce work to specified tolerances and finish, and stay on the job day after day with a minimum of maintenance, are profit-producing installations. Because South Bend Precision Lathes offer these, and other outstanding advantages, they are the choice of leading industries and shops everywhere. A South Bend Lathe distributor near you will be glad to help you select the lathes and equipment best suited to your requirements. Write today for his name and a copy of Catalog 100-D which illustrates in full color and completely describes the entire line of South Bend Engine Lathes, Toolroom Lathes, Turret Lathes, and Attachments.

Lathe Builders Since 1906

SOUTH BEND LATHE WORKS

432 EAST MADISON STREET • • • SOUTH BEND 22, INDIANA



You'll get peak production AT A PROFIT — with the *Speed-Matic**

Automatic electronic speed change, preselected for as many as ten stations. Complete range of spindle speeds—50 to 5000 RPM. Feeds from .0005" to .016" per revolution. Collet chuck capacity 7/8".

You can define the Speed-Matic's specifications with those facts—but you can't describe its production capacity till you've seen it *in operation*. Finished parts roll off like peas shucked from a pod—and with unsurpassed accuracy. We think you'll call it *The World's Fastest Hand Screw Machine.*

In the Speed-Matic maximum high production is combined with extreme accuracy, on lots of 25 to 500 or higher. Power feed, ram-type turret is teamed with a spring-return, hand-operated, cut-off slide.

* SPEED-MATIC—Add this new name to your metal-turning dictionary—you'll be hearing a lot of it—wherever rising production costs are a factor. The *Speed-Matic* is Monarch's answer to this problem in the hand screw machine field. Get full details *now*—from your nearest Monarch representative—or write us direct.

The Monarch Machine Tool Co.
Sidney, Ohio

ACCURACY · ECONOMY · LONG LIFE
Monarch
TURNING MACHINES

BUNELL

is the Name

IT'S A GOOD NAME...

synonymous with precision work ...covering 26 year's experience in

DESIGNING *and* BUILDING
Special Tools • Jigs • Fixtures
• Metal Stamping Dies
***and* Machinery**

It's an organization also geared to precision production of contract manufacture of parts and assemblies. Its personnel is made up of engineers and craftsmen—men who are designers and builders, specialists in their own right.

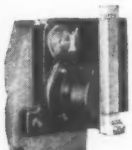
175 machines cover 40,000 square feet of floor space in a modern plant equipped to handle units from an ounce to 20 tons and up to 1/10,000 of an inch tolerance.

Bunell is a good company with which to do business. Jobs are done right at prices that are fair —always competitive. Estimates are furnished without obligation.

THE BUNELL MACHINE & TOOL COMPANY
1601 EAST 23rd STREET • CHerry 0343 • CLEVELAND 14, OHIO

MILLING TIME CUT 75%

4615 Alloy Steel Forging Milled in 3.8 Minutes on New Kearney & Trecker 50 CSM Milling Machine.
Former Time 15.7 Minutes



Here is one of those everyday, "run-of-the-mill," small-lot jobs done as fast and as practically as common-sense modern shop methods and equipment say it should be—namely, on a Kearney & Trecker CSM Milling Machine with a carbide cutter used to full efficiency.

CSM Milling Machines were designed to obtain the greatest benefits from modern cutting tools, and are now part of our line of standard models. The design has been developed after complete analyses of industry's problems of milling with carbide cutters.

Because they are knee type machines, they are readily adaptable to a great variety of work. They are precision built in accordance with long established Kearney & Trecker standards, and will cut metals faster and to finer tolerances and superior finishes than ever before, with high speed steel cutters as well as carbide cutters.

CSM machines are available in 20, 30 or 50 hp models in both plain and vertical knee types.

The part machined in this job is the operating ram used in a slotting attachment for Kearney & Trecker Milling Machines.

• • •

Here are the facts of this job taken from the operation and performance sheets. The machining time per piece with the old method was 15.7 minutes. Compare this with the performance shown below:

OPERATION: Face mill four sides
WORKPIECE: Slotting attachment ram
MATERIAL: S. A. E. 4615 forging.
2¼" x 2¾" x 18½"
MACHINE: 50 CSM Vertical
CUTTER: 6" dia., 8 Tooth CSM Carbide Face Mill with 7° negative primary rake angle — .020" wide
CUTTER SPEED: 275 rpm
TABLE FEED: 25 ipm
DEPTH OF CUT: ¼"
MACHINING TIME: 3.8 minutes ✓
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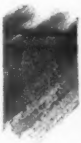

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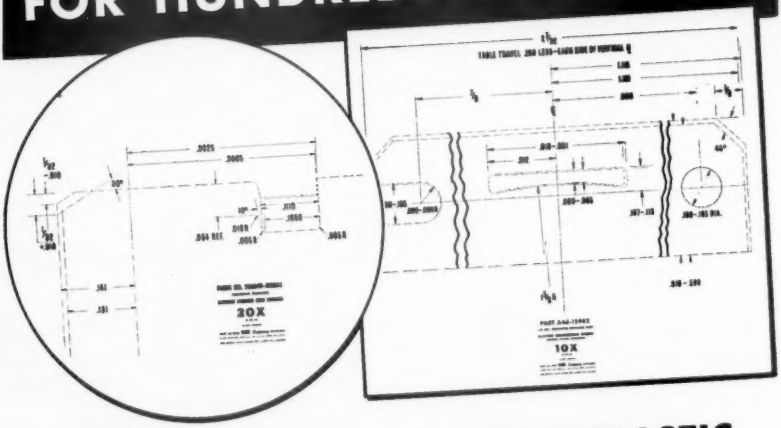

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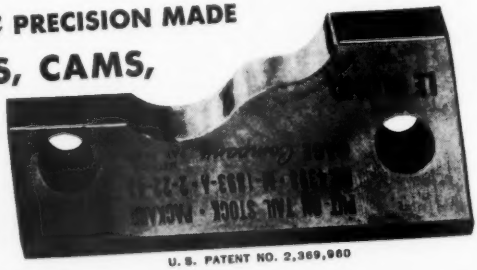

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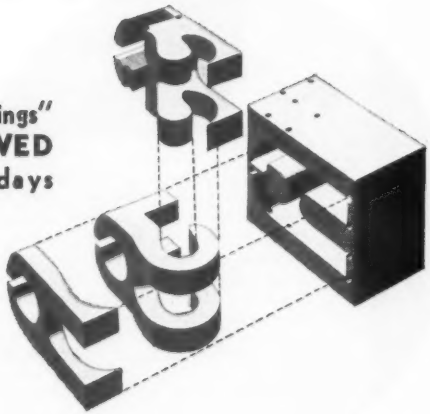

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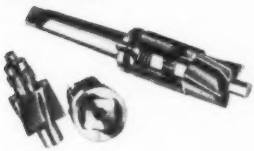

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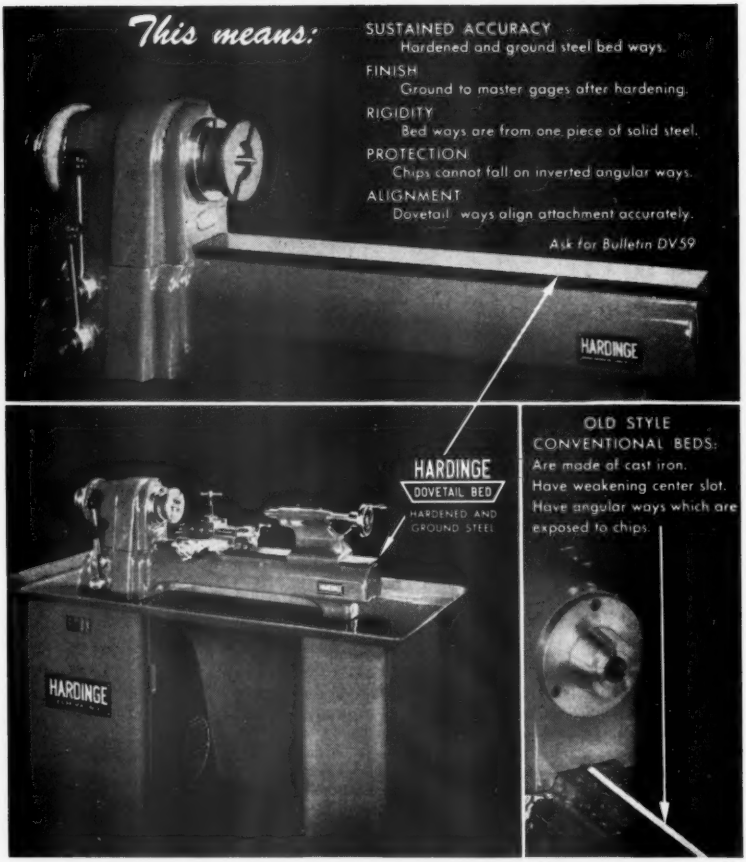

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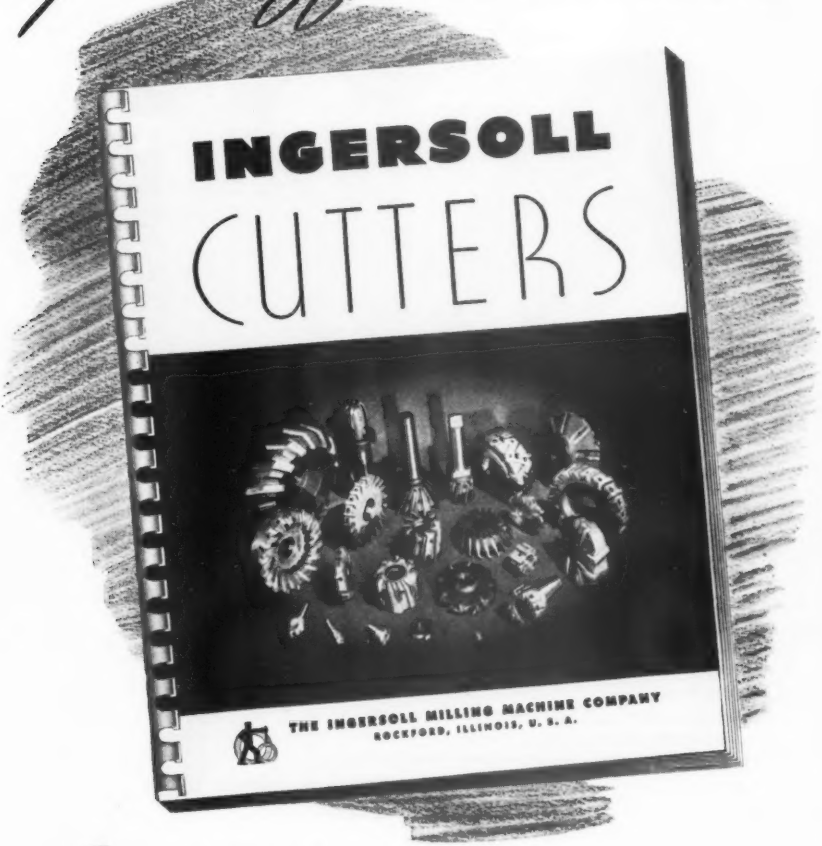

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EDITORIAL INDEX

	Page
Editorial: The Problem Is Not New	79
Progressive Die Designed to Pierce, Notch, Cut Off And Form	80
Special Planer-Type Miller Design Suggests Postwar Tooling Shortcuts by C. C. Soper	84
Six Basic Functions of Electronic Tubes	87
A Dry Wax Drawing Compound by Dr. A. L. Bunting	90
Gear Tolerances And Inspection Standards Evolve From War Production by Granger Davenport	92
Roller Bearing Pilot Bushings Insure Tool Rigidity And Alignment	95
TDJ Shop Data Sheets	97
Modern Techniques Of Personnel Relations by John D. Corrigan	101
KRW Press Designed For Light Weight, Low Cost	102
Versatile 24 Inch Disc Grinder	136
Automatic Hydraulic Cold Chamber Machine	138
Semi-Automatic Diamond Dressing Service	140
Precision Tapping	144
Blake Thin-Body Chuck	146
Anderson Power Scraper	148
New Power Factor Regulator	150
Automatic Clutch	153
New Open Back Inclinable Press	154
"Parlec" Workshop Tool	156
New 7½ KVA Automatic Spot Welder	159
Solid Carbide Blade Face Mill	160
New Bed Turret With Double Drive	162

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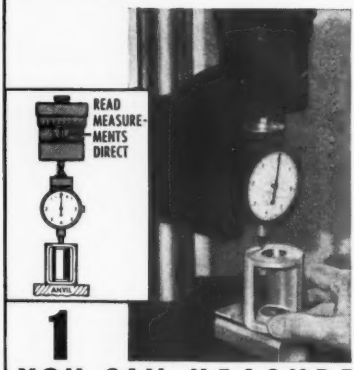

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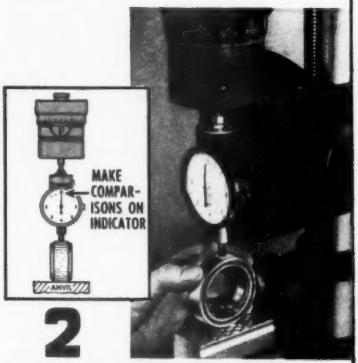

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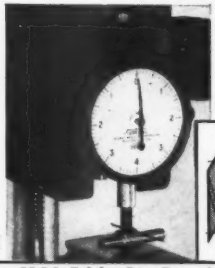

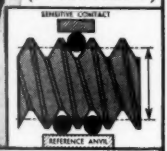

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PRECISION MEASURING INSTRUMENTS

We have made frequent reference on this page to the status of craftsmanship in toolmaking and metalworking. Responses from readers have shown that the problem is widely recognized.

One tool shop proprietor wrote: "In my own experience I found it very difficult to establish myself fifteen years ago as an apprentice, and I found it necessary to move around a lot, going from shop to shop, growing in skill as best I could and relying on the men with whom I worked to develop my knowledge."

Arthur A. Schwartz, a tooling authority of national repute, writing in the current issue of *Mechanical Engineering*, refers to a specific skill in toolmaking thusly: "* * * had to be done by experienced machinists, the kind that are scarce today."

An encouraging note comes from the activities, directed by president Richard F. Moore, of the National Tool & Die Manufacturers Association. Willis Ehrhardt, vice-president of the association and chairman of its fact-finding committee, reports that "In a recent survey, 280 typical tool and die shops throughout the country stated that they are training 1,111 apprentices. Of these, 3 out of every 4 are veterans. Extension of present apprenticeship programs promises eventual relief from the current shortage of tool and die makers, die sinkers and men of like skill".

One final quotation: "* * * Our progress in the appliances of the mechanical arts has outstripped our present methods of turning out workmen competent to handle the appliances. This growing scarcity of the skilled mechanic is undoubtedly due to the decadence of the apprenticeship system and the inadequacy of our present industrial and trade schools, excellent as they are, to meet the growing necessities of the case."

This last statement appeared in a technical publication of *August 1896!*

The problem is not new.

E. Willard Remington

editor

Progressive Die Designed To

This war production design of a progressive die which, in three operations, successively pierced, notched, cut off and formed an ordnance part, involves both design and construction features of postwar interest and application.

The die was manufactured by S. B. Whistler & Sons, Inc., of Buffalo, New York, and is presented here as an example of the incorporation of such standard punch and die components as are stock items into special tooling.

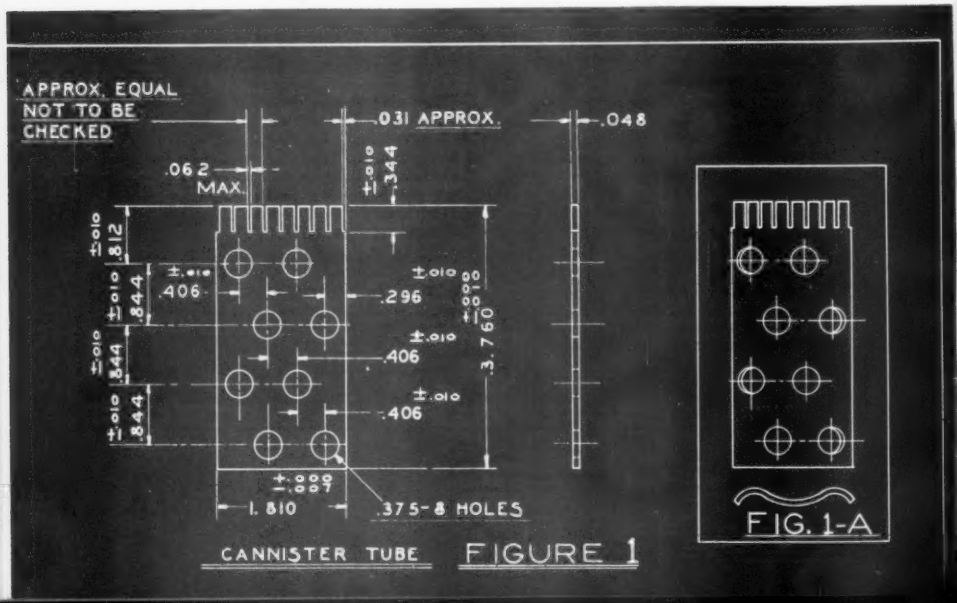
Shown in Figure 1 is a plan of the part after completion of the piercing and notching of the first two operations. Figure 1-A shows the workpiece after the third, or cut off and form, stroke of the press.

The overall construction and assembly of the tooling is shown in Figure 2. Sections through D-D and E-E are shown by Figures 3 and 4 respectively.

In operation, the brass strip stock of .048" thickness is fed into the die from the right to the manually operated primary stop. The stop is held in against its spring while the material is brought against it. The construction and cross-section of the stop are shown by detail C-C, Figure 2.

With the work located at this first position, the first stroke of the press pierces the rearmost rectangular pattern of four holes and cuts four of the rectangular notches (doubly spaced) in the edge of the strip.

For the second operation the stock is fed sufficiently further to the left for the tapered pilot or locating punch F, Figure 2, to engage the hole punched during the first stroke by the right-hand, foremost piercing punch G, Figure 2. The lead of the pilot punch accurately positions the work for the completion of the second press stroke, which pierces the second rectangular pattern of four holes and four more notches in the edge of the strip, interspaced with



the first four notches. At the same time the second stroke has also duplicated the initial piercing and notching pattern in the next following area of the strip.

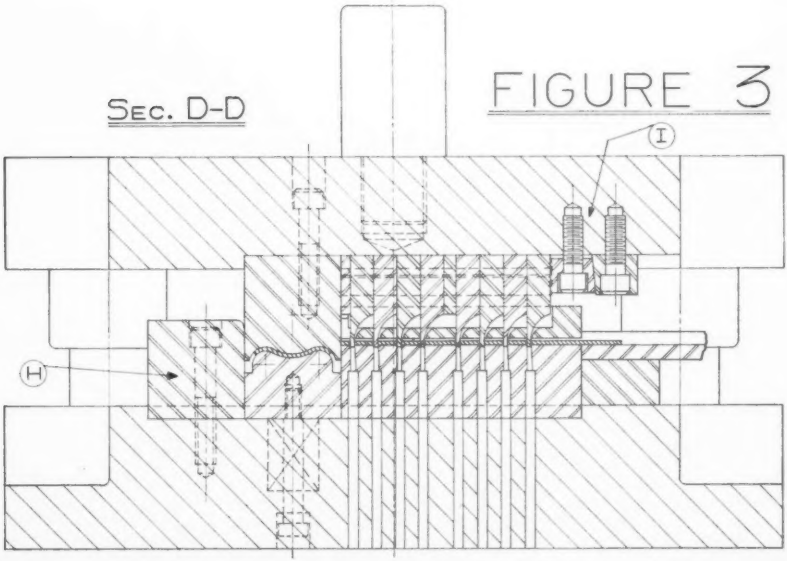
For the third stroke of the press, the stock is again hitched to the left and brought to a stop against the hardened and ground member H, Figure 2. This constitutes a slight over-feed of approximately one-half the width of a notch but the leading of the pilot punch into its indexing hole rectifies this and accurately locates the stock for the first cut off and form. And again, by the third stroke, an initial operation of four holes and four notches has been performed on the strip by the first piercing and notching punches to the right.

It will be noticed that the workpiece has seven full notches and two half-notches, there being one of the latter at each end of the row. Due to the interval of the feed, the eight punches make seven notches and two half-notches, and for this reason the first piece to be cut off and formed (third stroke) is waste because its leading edge has no half-notch. Each stroke of the punch after the third, however, produces a complete and symmetrically formed part.

The eight notching punches D-D, Figure 2 and Figure 3, are secured in the punch pad by the wedge locking members and screws I, Figure 3, and the tongue and groove and wedge construction as shown at J, Sec. A-A, Figure 2.

When the ram is up, the bottoming punch or pad is at such a height as to serve as a support while the stock feeds across to the blanking stop H, and after cut off the form is imparted by the profiled punch and mating pad during the balance of the stroke. After forming, the spring actuated pad rises and functions as the work knockout.

The upper and lower punch and die holders, of 2¼" and 3" respective thicknesses, were made of SAE No. 1045



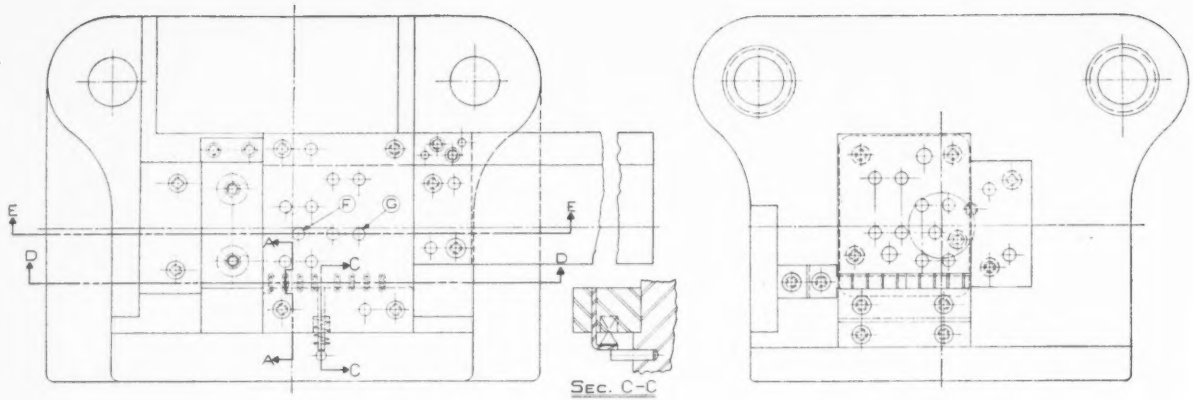
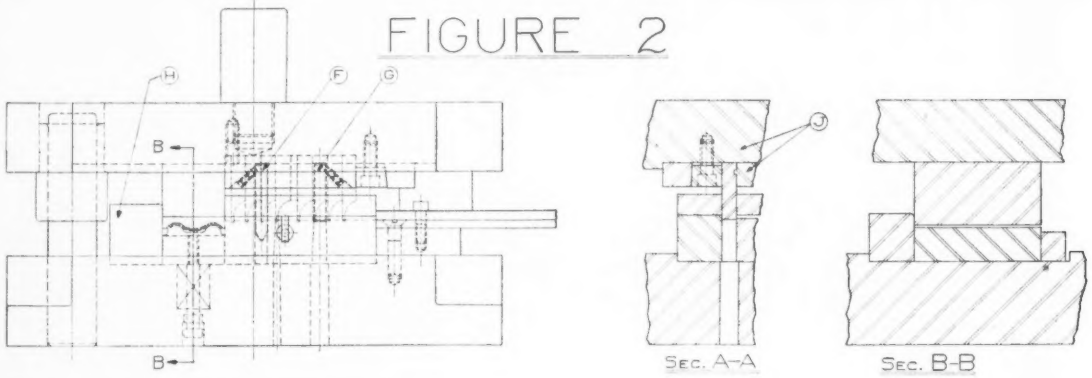


FIGURE 2



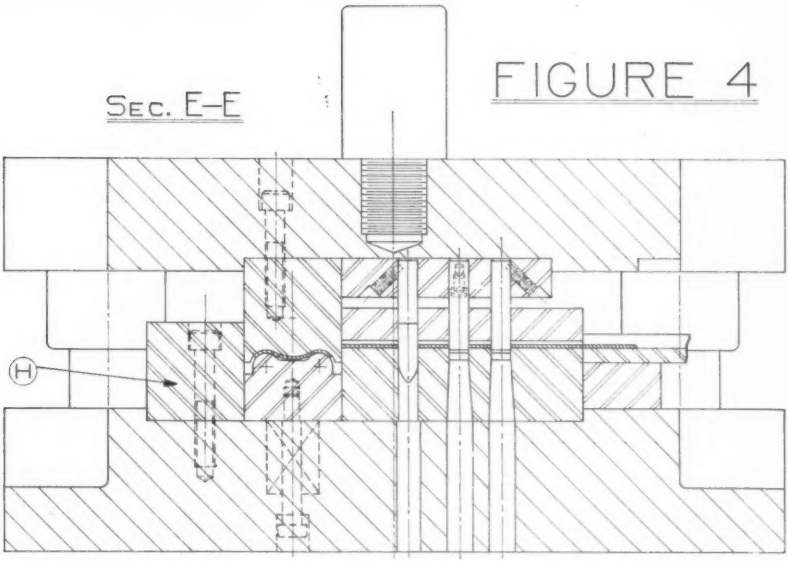


FIGURE 4

steel, end-milled and sawed to conventional shapes for clamping and clearance.

First among the standard die makers' supplies to be mentioned as entering into this special tooling are the 2" punch shank, the 1½" x 7" guide posts and the 1½" guide post shoulder bushings. Those as specified and used were precision parts of Danly manufacture.

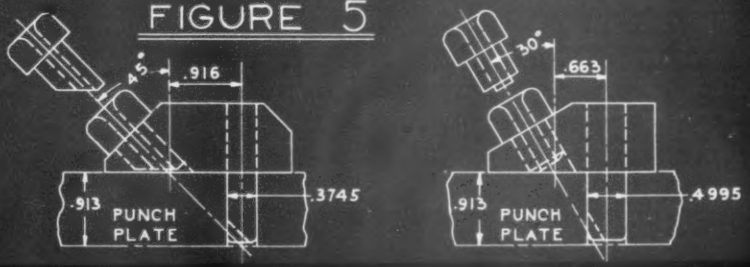
Also combined with the parts of special design in the tooling setup are the round piercing punches G (Figure 2 and cross-section E-E, Figure 4) and the piloting punch F (Figure 2 and cross-section E-E, Figure 4) which are standard Whistler punches.

Shown also are the drilled and tapped holes for the angular set screws that secure these units to the punch pad.

In addition to the man-hour and dollar economies attained by employing these standard punch parts, their use is greatly facilitated by the drilling and tapping jigs, also of Whistler manufacture, which are now available for all standard Whistler punches and die bushes. Two styles of jig are shown in Figure 5. Each jig embodies a pilot member that enters the accurately located punch mounting hole in the punch pad and is supplied with two slip bushings, one of tap drill size and one of tap size. Their use insures accurate locating of the punch and bush retaining screws in relation to the angular seats in the punch shanks and die bushes.

Grateful acknowledgment is made of the cooperation of L. V. Whistler, Vice-Pres., and E. L. Hamilton, Chief Tool Designer, S. B. Whistler & Sons, Inc., in selecting and preparing this press tool article for publication. As a progressive die project it incorporates a sufficient variety of clearly detailed design and operating features as to make it well worthy of group study and discussion by apprentice toolmaker classes. ED.

FIGURE 5



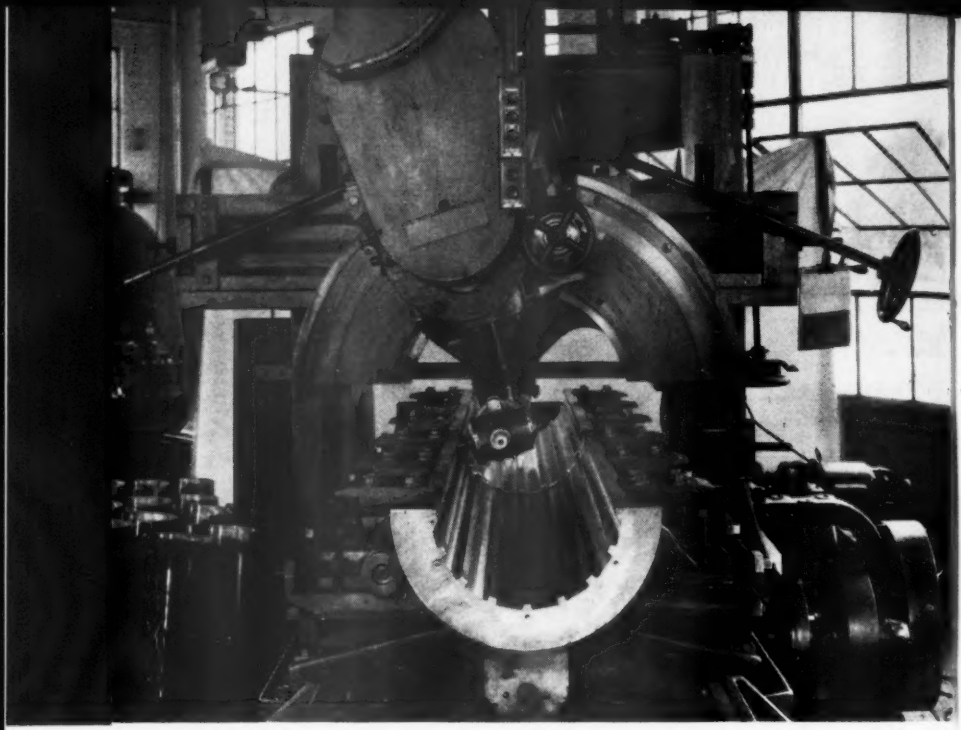


Fig. 1: This special planer-type miller was designed for longitudinally slotting bearing shells. The work ranged in size up to 28" ID and 10 ft in length.

Special Planer-type Miller Design Suggests Postwar Tooling Shortcuts

Editorial Note: This account of the solving of a challenging production problem is suggestive of the flexibility and versatility of the conventional planer over and above its most common usage. The planer has great work holding capacity as to both weight and bulk. Its coordinate movements, horizontal table travel and crosshead horizontal and vertical travel, result in most all areas of a workpiece being accessible to the toolhead. The saddle can be equipped with a single point tool, a formed tool, a drilling head, a grinding spindle, or, as in the case described here, a milling head. The possibilities of tooling a planer for a multiplicity of purposes offer definite advantages to the tool shop, tool room and contract manufacturer.

The special planer-type milling machine illustrated in Fig. 1 was designed and built by the Ferry Machine Company, of Kent, O., for the specific job of machining dove-tail slots in propeller shaft bearings of naval and commercial craft. The milled slots are for the insertion of rubber bonded brass strips around the interior surface of the bear-

ing shell which form the bearing in which the underwater shaft revolves.

The increasing submarine menace of early 1940 necessitated a greatly increased production of these marine bearings, and, since speed was the essence of their contract, the Ferry Machine Company rapidly evolved a design associated with a planer having a generous table which could offer great accessibility for chucking the work.

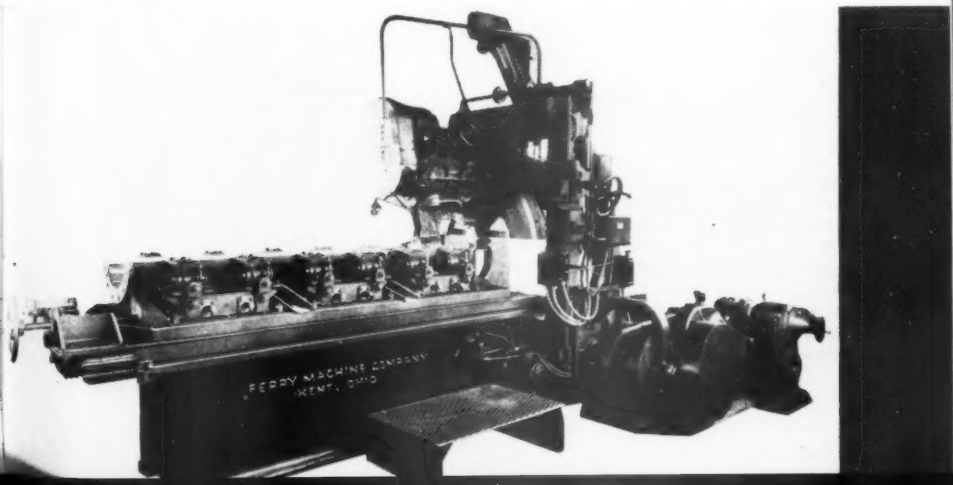
by C. C. Soper
Chief Engineer
Ferry Machine Company
Kent, Ohio

The minimum bearing inside diameter plus depth of slot determined the radial working space within which the milling tool head had to operate. The design, consequently, hinged around a cutter spindle housing which could rotate within a 7½" diameter semi-circle in order to accommodate the smallest bearing shell.

This small housing with restricted interior space for gears, bearings, spindle, etc., offered no opportunity to provide internal adjustment for size or depth of cut. For this reason the cutter spindle housing was mounted on a neck-like extension or bracket bolted to the bottom of a gear box which was suspended at clearance height above the plane of work and clamps. This gear box was supported to the cross rail by two adjustable slides each at right angles to the other. Both slides were actuated through lead screw spindles and gearing, and both screws were equipped with hand wheels, incorporating resetting discs graduated to read to one-half thousandths. The entire gear box and both slides swivel in a plane parallel to the cross rail, around the geometric center of the bearing shell when clamped. The swivelling movement is imparted by two worm and segmental worm gears which are hand-wheel operated from both sides of the machine. See Figure 3.

The cutter head was also made to swivel in its housing so that the milling cutter could be used in three positions, vertically or at right angles, on either the right-hand or left-hand side. The three positions of the cutter head reduce the required angle of swivelling about the center line of the bearing, to plus and minus 45°. This enables the extreme outside slots at the bearing split line to be reached with the cutter, without having the housing extend down to the point

Fig. 2: Front view showing a partially machined bearing shell. The milling head is positioned for a top side cut.



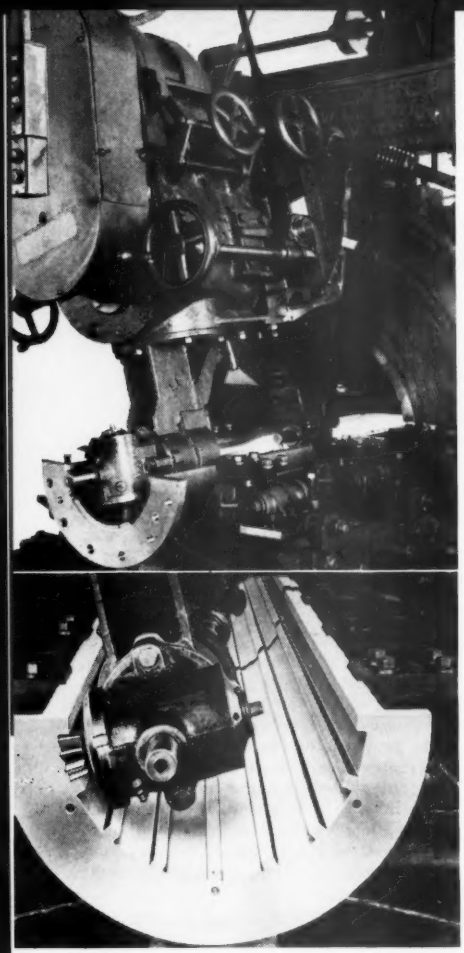


Fig. 3, Top: Close-up of spindle head and spindle change gear box, showing also the slides and controls for cross and down feeds and angular indexing.

Fig. 4, Bottom: An initial roughing cut being taken with the milling head at a 90° setting.

of interfering with the table or with the clamping mechanisms during the reciprocating movement of the table. See Figure 4.

A two-speed motor, together with the change gear combinations controlled by levers at the gear box and also by belt changes, make possible a total of 16 changes in spindle speed. Variations in cutter surface speed cover a range of from 75 sfm to 425 sfm.

The table surface speed varies from ½ inch per minute to 60 inches per minute. For setting-up purposes, when indicating the location of the work center line, a table speed of 50 feet per minute is available.

The use of carbide cutters has been very successful. Roughing is done with a 3 or 4-lipped cutter making a rectangular slot full width at top and full depth minus .040". This cutter will rough the naval bronze at approximately 2½ lbs of chips per minute. A higher cutting speed is limited, however, by vibrations resulting from the overhang of the cutter head. Rough finishing is completed in one cut by removing the two V-corners and approximately .025" on the bottom. Final finish is made at high speed up one side and down the other, on each slot, removing the balance on the angle sides and approximately .015" on the bottom. Final size is best maintained in this manner.

The chucking device has hardened and ground surfaces where contacting the OD of the bearing. The chucking unit consists of three separate stations with spaces between and at the ends of each. This permits the bearing flanges to drop into the clearance recesses and thus two or three small bearings can be machined simultaneously. These three chucks are connected on both sides to a longitudinal spindle having a hand wheel on the front end of the table. All jaws are universally operated from this hand wheel. Each individual jaw, however, has an independent slide capable of separate adjustment. Each slide also carries a quick operating clamp mechanism capable of instantaneous application at any height. From minimum to maximum height, clamping may take place with a facility equal to that of the lower positions. The clamping is sufficiently positive so that the horizontal thrust of the cut only requires that the tightening be done very lightly with a tool post wrench.

Centering and aligning the bearing is done by adjusting the sides to centralize the hardened plug, on the front of the spindle housing, and using an indicator

(CONTINUED ON PAGE 167)

Six Basic Functions Of Electronic Tubes*

The increasing application of electric controls to metal working procedures is due to the sensitivity and multi-capabilities of this device which has sprung from "the Edison effect", the DeForest Audion, the Armstrong regenerative, and which has become glorified by the term Electronic Tube. Herewith is a graphic presentation of its basic functions.

Electronics now facilitates production in many industries and has applications as various as x-ray, air cleaning, radar, electronic amplification and high frequency heating. Since the duties of many workers in industry now include the operation of electronic devices, it has been felt that an explanation of exactly *how* electronic tubes work would be valuable in promoting an understanding of their various applications.

The typical two-element electronic tube

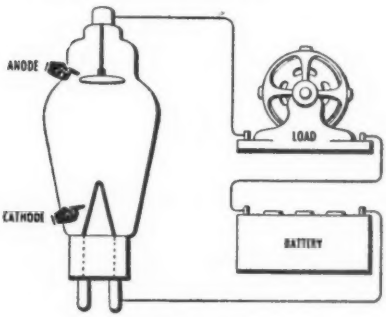


Fig. 1

(Fig. 1), which is called a diode, resembles an ordinary single-pole switch in its operation. It can connect a battery and its motor, with one power lead going to the anode and the other to the cathode. The anode and cathode correspond to the contacts or poles on a switch. When the "switch" is open, the contacts are insulated from each other by a vacuum or by some inert gas which has been inserted into an evacuated tube under low pressure.

To close this switch electronically, it is necessary merely to heat the cathode, and give the anode a positive potential. As the negatively-charged electrons (Fig. 2) are emitted from the surface of the heated cathode, they fly at tremendous speed to the anode. Thus a current carrying path is formed which closes the circuit and permits the motor to operate. The direction of electron flow is contrary to the usual concept of current flow from plus to minus.

An electronic tube, then, is basically a form of a switch, and its application at the present time follows one or the other of six fundamental functions.

First of all, it can be used to rectify current, converting ac to dc. This is done by merely connecting an electronic tube in a series with an ac circuit. As you will note from the diagram (Fig. 3), only the positive half-waves of ac voltage will now produce a current. When the negative portion of each wave is applied to the anode, the electrons are repelled and no current flows. Since only the cathode can emit electrons, the current can travel only in one direction. Thus the alternating current is converted into pulsating direct current by means of the electronic tube.

The applications of this basic rectifying principle are many and important:

*Compiled from "The ABC of Electronics at Work", an informative, illustrated booklet recently issued by the Westinghouse Electric Corp., East Pittsburgh, Pa.

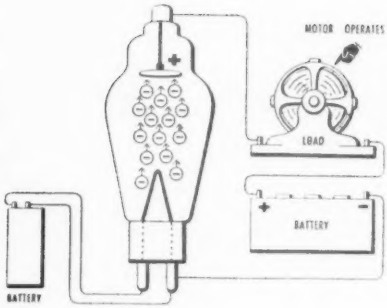
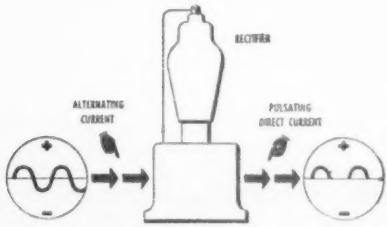


Fig. 2

changing ac to dc on electrified transportation systems; in electroplating (where operation is possible only with direct current); for the driving of variable speed motors, and in vital reduction processes requiring direct current to extract aluminum from bauxite ore, electronic rectification is used to obtain direct current from ac transmission lines. The Westinghouse Ignitron Rectifier utilizes this principle with extreme efficiency, as does their Precipitron, a device for cleaning air electrostatically.

The second basic function of the electronic tube is amplification. Between the cathode and the anode of the basic two-element tube, a grid is placed (Fig. 4). This grid is connected to an input of some weak voltage which is to be amplified, such as a faint radio signal. Every time a negative potential is impressed on the grid, even though it be very minute, it has a large effect in reducing the number of the negatively charged electrons which would otherwise be flying from cathode to anode. Conversely, when the grid carries a positive potential, an equally large effect is exerted in increasing the flow of electrons from cathode to anode. This means that a small amount of power applied at the grid is amplified into a large amount of power in the anode or work circuit.

Fig. 3



This amplifying property of the three-element electronic tube is used in innumerable ways today, including radio and radio telephone contact between ships or airplanes and their control stations or bases, and measurement and analysis of minute impulses in dynetric balancing.

A third adaptation of the electronic tube is generation of alternating current. A grid is again employed as a third electrode, forming a triode (Fig. 5). This system is capable of changing direct current into alternating current.

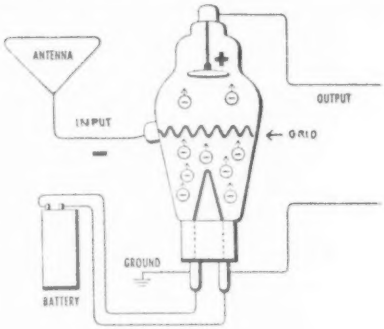


Fig. 4

The amplifying is accomplished by the grid in the usual way, and then a *part* of the amplified voltage is fed back to the grid. Repetition of this feedback results in an alternating current. This electronic means of generating alternating current is important because it can produce very high frequencies, up to millions of cycles, which are far beyond the range of ordinary rotating equipment.

One of the most commonly known applications of electronic high frequency generation is the familiar radio transmitter. It is also used to "flow" tin in the electrolytic plating of steel strip. Uses in the plastics industry include the dielectric bonding of plywood, heating of plastics preforms, and curing of thick plastics forms; in each of these processes

dielectric heat has been found to be more thorough, and many times faster than conventional heating methods. Because of its uniform penetration it can be used on thick preforms, for example, where ordinary heating would polymerize the surface before the material at the core had been sufficiently warmed, due to the low heat conductivity of plastics.

A fourth use of the electronic tube is as a controlling device. To control the flow of power by electronic means, the control circuit is connected in such a way that it becomes a function of temperature, speed, time or some other variable (Fig. 6). As a result of changes in an element of the control circuit, the grid potential is varied, and the work circuit is automatically closed, opened, or modified, with split-second timing and great precision.

Automatic, stepless regulation of motor speeds is one application of electronic control. Without the smooth acceleration which such control permits, many precision machining operations would be impossible. The electronically controlled resistance welder, on which the elec-

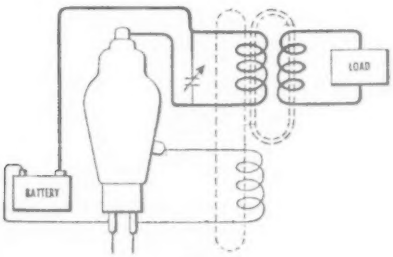


Fig. 5

tronic control can quickly make and break circuits with extremely precise timing, is another important application.

The fifth type of use for the electronic tube is the transformation of light into electrical energy. To do this, the ordinary heat-activated cathode of a two-element electronic tube is replaced by one made of photo-sensitive material. Light can now replace heat as the stimulator of electronic emission. The stronger the light, the greater the electronic emission, and consequently, when

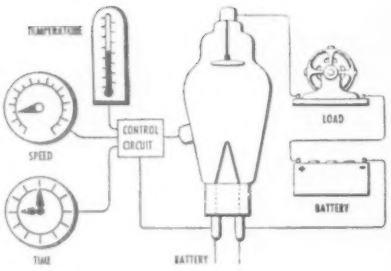


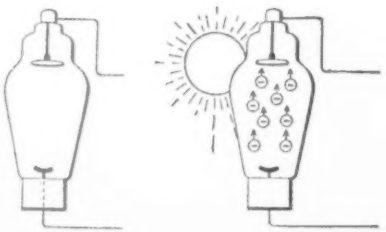
Fig. 6

amplified, the more power flowing through the work circuit. By this means photoelectric tubes can function as light relays, and they are thus used in television, iconoscope, and in safety and inspection devices such as the Westinghouse electronic eye which spots pinholes in metal strips as they come from the mills, and automatically operates a relay that marks the defective sections for rejection.

Last of all, but not least important, the electronic tube can convert electric current into light. The cathode ray tube used in television receiving sets is one application of this property. Others are the x-ray tube used with the fluoroscope, the fluorescent light, and the Sterilamp.

The electronic tube, then, which is the basis for so many of the more advanced techniques and processes in industry, is in essence merely a switch. But it is a switch which can rectify, amplify, generate, control, and transform light into electricity, or electricity into light, thereby opening new fields of development in scientific and industrial processes.

Fig. 7



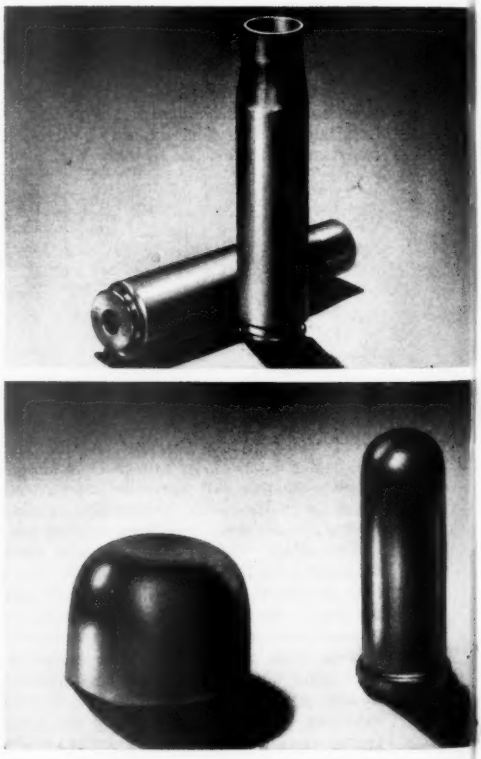
A Dry Wax Drawing Compound

by Dr. A. L. Bunting
Technical Director
Plasteel Corp., Ecorse, Mich.

In the deep drawing of metals the crystal junction temperatures have been estimated to exceed 1750° F. While the volumes in which these temperatures occur are small as compared to the mass (volume) of the piece, the problem is most troublesome because the pressures at which these draws are made frequently cause a breakdown of the lubricating film; this results in that minute welding of the die to the piece which is commonly referred to as scoring.

During the war these problems became more and more acute, due to the heavy production schedules and to the severity of each operation, plus the fact that in many instances pieces were being fabricated in three draws that in prewar times would have been made in five.

Under such conditions of increased pressures and work per operation, the conventional oils and lubricants began to break down with a resultant loss in production. The laboratories of the Plasteel Corporation in Detroit studied this problem particularly as it affected the 20mm cartridge case. Through this investigation there was developed a wax drawing lubricant that possessed extremely high film strength even at elevated temperatures and which had good adhesion to the metal. Thus the piece being drawn was fully insulated from



Top illustration: 20mm brass and steel cartridge cases. Four draws on each case with bright anneal between draws. Over 50,000,000 finished cases made with Plasteel compound. Lower illustration: Nose piece. Involved cupping, followed by four successive draws with one application of compound. No anneal between draws.

the die, resulting in no metal to metal fusion.

The compound is mixed with water and the pieces are immersed for a few seconds and dried, after which they may be drawn at any time. The dry coating is almost imperceptible and feels slightly waxy. Pieces go through the drawing operation dry without the use of any other lubricant or coolant. If sequence draws are desired, it has been found that up to as many as five draws may be run in succession without recoating the work; sufficient residual compound remains from preceding draws to lubricate the punch and die sufficiently for subsequent operations. The pieces may be easily cleaned by any mild alkaline solution such as soda ash, etc.

Principally, the compound has been used on steel and brass. Steel discs nearly one inch thick have been successfully cupped and drawn by using the compound. Draws on alloys of copper, aluminum, nickel and cobalt have been reported as extremely satisfactory, and in many instances it was the only material with which certain draws could be accomplished.

The drawing compound permits latitude in the rearrangement of equipment and manufacturing procedure so that more uniform products are made with fewer operations. Largely because of this ability to combine operations and to eliminate others, one manufacturer, using the wax drawing compound, reports that he is now using 30 operations to manufacture a completely processed piece where previously 48 had been involved.

In many instances the material is reported to increase die life and lessen die maintenance. While relative comparisons are meaningless in specific instances, the overall reports in this respect indicate satisfactory performance. One user advises he is using only one die setup man in his plant where previously 12 were required.

Due to the fact that a continuous, nearly imperceptible film of wax covers the pieces, it is possible to build up or accumulate appreciable stocks before and after drawing operations with a minimum of danger of rust or corrosion from atmospheric conditions. This contributes to flexible shop schedules and tends toward economical and smooth operation. It is possible to run lots completely through an operation, change dies and use the same machine for the subsequent operation, or to process certain operations on one shift and to leave the pieces for later operations. Furthermore, the adaptability of the material to various metals eliminates the necessity of having more than one drawing lubricant.

Mortar projectile. Three draws after the coining operation. An example of exceptionally heavy work.

Inasmuch as the compound is used dry, it has the important advantage of being clean to handle. Presses are clean, as are the operators' hands and clothing. Boxes in which the processed pieces are handled and stored are clean and remain clean, and the floors of the plant do not become slippery and dirty from dripping and splashing oil.

Additional specifications and performance data covering these drawing compounds may be obtained by use of our postage-free Inform-A-Gram Key No. C78-O.

Gear Tolerances And Inspection Standards Evolve From War Production

New American Standard covers spur and helical gears, bevel and hypoid gears, and backlash in gears.

It is fortunate that at the start of the war the standardization of gear tolerances had made considerable progress, even though it had not yet become American Standard. Information on this subject in the form of tables had been made available to gear manufacturers as well as having been published in the technical press. Many newcomers in the gearing field—designers, gear manufacturers, users—had access to this information, and were able to utilize it to good advantage, either directly in its original form, or suitably modified for particular applications.

by Granger Davenport
Assistant Chief Engineer
Gould & Eberhardt, Inc.

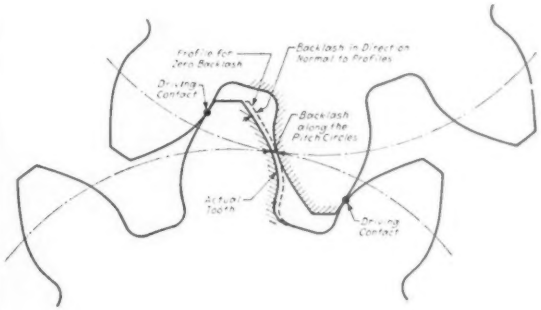
As the war progressed, the tremendous production of all kinds of gears, ranging from fine instrument gears to large ship-propulsion gears, afforded an excellent opportunity to improve and extend the project, until it was ready to propose as an American Standard.

The new American Standard on Gear Tolerances and Inspection, B6.6-1946, is made up of three parts—Section 1, Spur and Helical Gears; Section 2, Bevel and Hypoid Gears; and Section 3, Backlash in Gears. It includes gears ranging from ¾ inch to 100 inches in diameter, and from 1 to 32 diametral pitch, with a wide choice of tolerances varying according to several speed and accuracy classifications.

At some future date it is expected that sections will be added to include worm gearing, gear-blank tolerances, measurement over pins, master gears, and fine-pitch gears. Some of this material is already developed and in use as standards of the American Gear Manufacturers Association.

The present section on backlash supersedes the American Recommended Practice on Backlash for General Purpose Spur Gearing, B6.3-1940, which is applied only to spur gears. The principal change is that backlash is now specified in a plane of rotation rather than normal to the tooth profile, thus making the table of backlash applicable to other kinds of gears besides spur. The relation of these two methods of measuring backlash is shown in the following illustration reproduced from the new standard.

The project to establish gear tolerances originated in the Gear Inspection Committee of the American Gear Manufacturers Association about eight years ago. The committee soon learned that gear-tooth tolerances were (and still are) a highly controversial subject for a number of reasons. Among these are the widely varying methods of inspection in different plants, the common use of various combined checks in which the individual errors are not separable, and



Backlash is now specified in a plane of rotation rather than normal to the tooth profile in the new American Standard for Gear Tolerances and Inspection. This makes the table of backlash applicable to other kinds of gears as well as spur gears. The relation of these two methods of measuring backlash is shown here.

in many cases the complete lack of inspection facilities by either gear maker or user. Then, too, certain types of errors, such as error in pressure angle or lead, can often be readily compensated by the shop man who introduces similar errors into the mating gears and obtains just as satisfactory results as though the pressure angle or lead were strictly according to drawing specifications. This is as it should be, yet it is certainly not a valid argument against establishing gear tolerances and inspection methods, for in all the sciences, man's progress has gone hand in hand with his ability to measure.

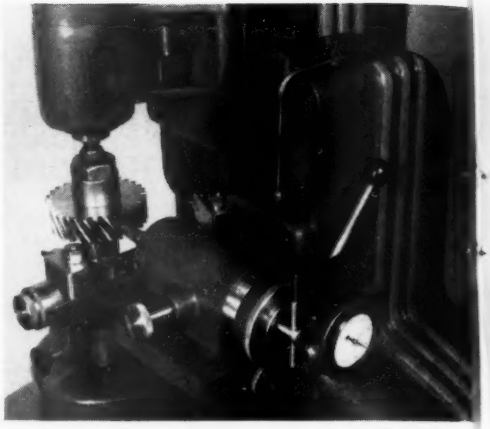
As would be expected in starting a task of this sort, the committee first gathered all possible information from publications, gear suppliers, gear users, and manufacturers of gear-cutting machines and checking instruments. It was soon evident that data from these sources, while perhaps satisfactory for certain limited gear applications, were far from being an adequate basis upon which the committee could formulate a standard. The British Standards covering spur, helical, and bevel gears were carefully studied, and although they contain excellent data on gearing in general, their tables of tolerances were for the most part entirely too liberal to meet the standards of gear accuracy prevailing in the United States at the time. Consequently, it was necessary to start almost from scratch to build up the present tables of gear tolerances.

When tentative tables of tolerances had been established, it was found that they were of little use until accompanying definitions, illustrations, and descriptive methods of testing were added, all of which now swell the standard into a practical treatise on the subject of gear inspection. The section on backlash, particularly, contains much new information that had never been correlated and publicized before.

One very controversial issue centered on whether to include the composite check and suitable tables of tolerances. This is an inspection method in which the gear is rolled tightly in mesh with a

Where large numbers of gear shaving machines are in operation, this machine facilitates setting the crossed axis angle on the shaving machine. The gear, with an indicator contacting one of the tooth surfaces, is guided past the indicator by a master lead on the same spindle. Photo courtesy Michigan Tool Co.

Setup for tooth profile inspection on a Sine-Line Involute Checker which works on the sine bar principle. Movement of the tooth profile contacting finger and rotation of the gear are synchronized so that the indicator reading can be taken to chart the tooth profile. Photo courtesy Michigan Tool Co.

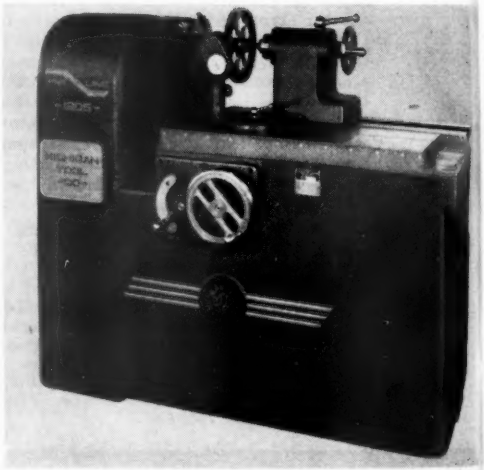


master, and changes in center distance observed or recorded on a chart. In the end, this test was omitted, mainly for the reason that to include it would have greatly lengthened and complicated the standard, although its value as a routine check for mass production is widely recognized. Moreover, it is only practical for gears of relatively small size in comparison with the large range of diameters covered by this standard.

When each individual section was completed in tentative form, it was given wide circulation. The many comments received were indicative of a lively interest on the part of both gear makers and users, and particularly of the need for such standards. Finally, each section became an AGMA Standard, and each was published in one or more trade magazines. Since June 1943, the material has been available in printed form as a Proposed American Standard sponsored both by the AGMA and ASME, and about 500 copies circulated for comments and criticism.

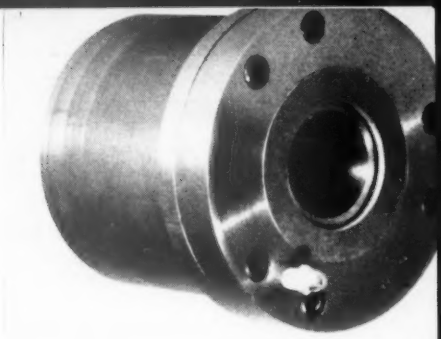
In spite of all this publicity and several years of practical application, it is not claimed that this standard is perfect. Many changes will be required from time to time as progress is made in the manufacture, inspection, and application of gearing.

Neither is it claimed nor intended that these tolerances are to form a rigid specification for gear accuracy. Rather it is emphasized that ultimate performance is the final criterion in the acceptance or rejection of gears. But when gears fail to perform properly, definite inspection methods and tolerances prove an invaluable aid in locating the cause and overcoming the difficulty. And last, but not least, the gradual trend toward manufacture of more and more gears on an interchangeable basis, and demands for quieter and smoother gears, and higher load-carrying capacity, call for maintenance of gear tolerances within ever closer limits.



Misalignment of tooth surfaces or conditions of mismated helices can only be avoided by checking parallelism of spur gears or lead of helical gears. This equipment will check helix angles on helical, worm or spur gears from zero to infinity. By turning a single hand wheel, alignment errors are read on a .0001" indicator or may be automatically recorded. Photo courtesy Michigan Tool Co.

Roller Bearing Pilot Bushings Insure Tool Rigidity and Alignment



In precision work, where spindle or chucking fixtures or stationary fixtures incorporate a bearing for a piloted tool, every precaution must be taken that the bearing performance is equal to the job. Conventional pilot bar bearing surfaces, in steel, cast iron or bronze, can become loaded with chips and abrasive dust to such an extent as to perform a destructive lapping job on the tool pilot bar, with the result that the bushing and pilot must be frequently replaced.

An anti-friction pilot bushing that provides friction-free turning in relation to the pilot bar has been developed by the Jergens Company of Cleveland, Ohio.

As is evident from the illustration of the assembled bearing and the "exploded" view of its components, the bushing housing rotates in relation to the pilot bearing surface, hence between the pilot bar and its guiding quill there is no relative rotary motion, but only the sliding motion corresponding to the feed of the cutting tool.

In addition to long life, another advantage of the roller-bearing pilot bushing is freedom from chatter. If, over a long period of time, any wear does occur, the bearing may be readjusted and preloaded simply by taking it apart and surface grinding a few thousandths from a special ring that separates the two cones. The bearing quill or inner member is hardened, ground and lapped, and

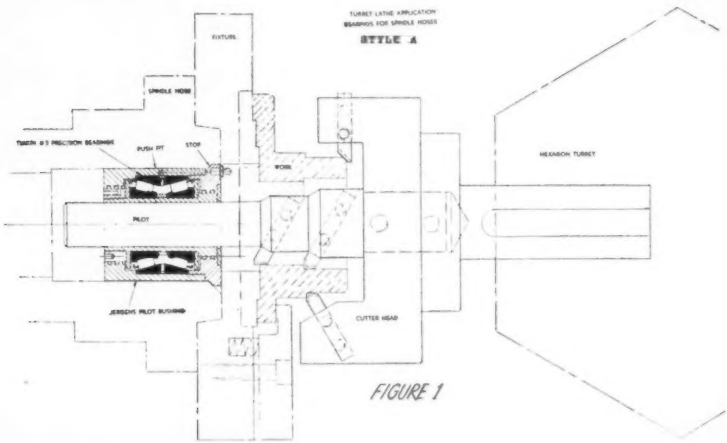
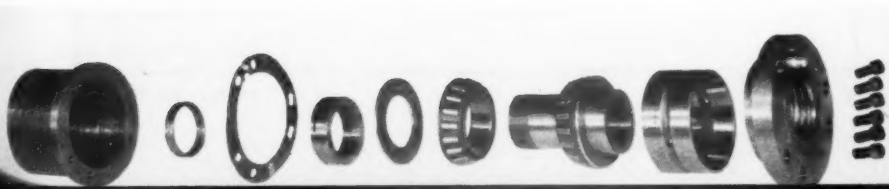


FIGURE 1



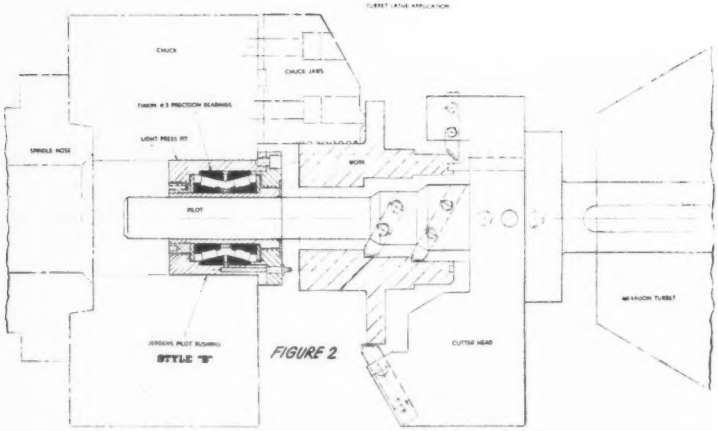


FIGURE 2

upon assembly the OD of the bushing is dead arbor ground, all to insure perfect concentricity.

In the turret lathe tooling shown in Figure 1, the OD of the spindle nose type of bushing was ground to a push fit in the spindle, and it locates against the ⅛" x 45° inside front bevel of the spindle bore. This style of bushing is available for spindle bores of from $1\frac{13}{16}$" to $12\frac{5}{8}$".

The flanged type of bushing is shown in Figure 2, as used with a chuck mounted on the spindle nose. In this application the chuck was bored while in place to a light press fit for the 3.3125" OD of the bushing.

The boring fixture of Figure 3 incorporates two of the flanged type of bushing and provides two piloted supports for the cutter bar. This job was run in a radial drill and the fixture itself was allowed to float. Where the fixture must be clamped a floating holder drive should be provided. Use INFORM-A-GRAM Key No. J18-O.

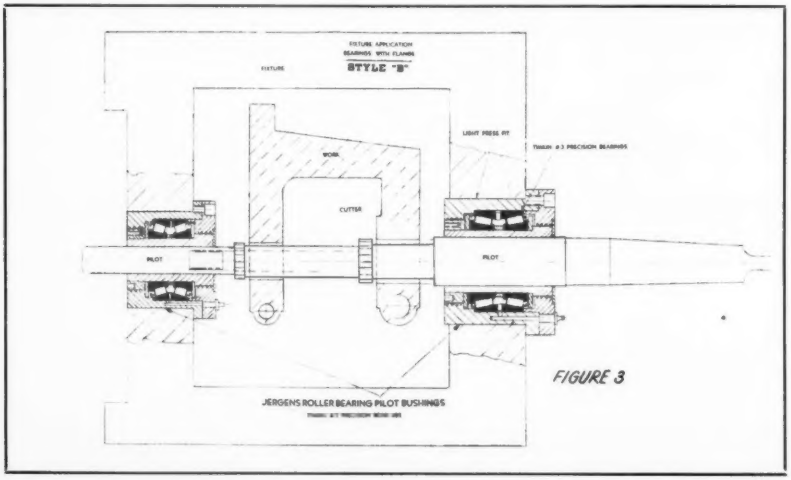


FIGURE 3

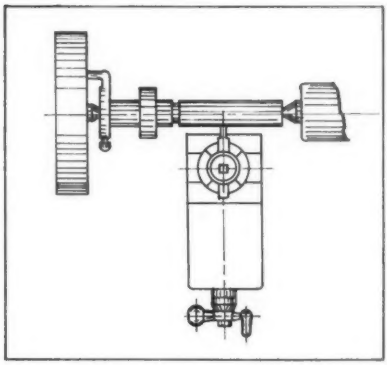
TDJ SHOP DATA SHEET NO. 42

Lathe Settings For Fine Finishing Cuts

The depth of cut, taken on a workpiece in lathe turning, is controlled by the compound rest micrometer feed screw.

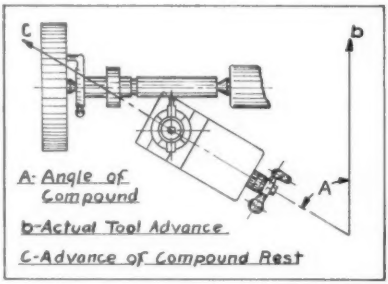
Controlling the rough and normal cutting depths is an easy operation, but the finish cut of a half or quarter thousandth of an inch is difficult to control because the required value has to be estimated on the micrometer dial. However this is greatly facilitated by setting the compound tool rest at an angle, so that as the compound rest is moved by the feed screw, it travels along the hypotenuse of the triangle, while the tool advances along one leg of the triangle. Therefore the distance the tool advances is not as great as that of the compound. The accompanying sketches illustrate this procedure.

The value of the actual advance of the tool



comes from the cosine of the angle, that is

$\cos A = \frac{b}{c}$, where b is the unknown quantity, or tool advance, then, $b = c \times \cos A$. A = the angle setting, c = the micrometer setting. For example, the diameter of a workpiece is to be reduced .001". Under regular operations, the micrometer dial would be set for a .0005" cut and this value would have to be estimated on the dial. However, if the compound rest is set at a 60° (A) angle, and the feed screw advanced .001" (c), then we derive the tool advance (b) from the formula,



$b = c \times \cos A = .001" \times .500 = .0005"$. $.0005" \times 2 = .001"$, the reduction in diameter.

Lathe grinding attachments can be set up in the same manner in order to work to close tolerances.

The accompanying table gives the required angle to which the compound rest should be set for diameter reductions ranging from .0001" to .002" as the tool is advanced in .001" steps by the compound feed screw.

Angle of Compound	Feed of Compound	Depth of Cut	Reduction of Diameter
0° 0"	.001	.001	.002
18° 11"	.001	.00095	.0019
25° 50"	.001	.0009	.0018
31° 47"	.001	.00085	.0017
36° 52"	.001	.0008	.0016
41° 24"	.001	.00075	.0015
45° 34"	.001	.0007	.0014
49° 27"	.001	.00065	.0013
53° 7"	.001	.0006	.0012
56° 37"	.001	.00055	.0011
60° 60"	.001	.0005	.0010
63° 15"	.001	.00045	.0009
66° 25"	.001	.0004	.0008
69° 30"	.001	.00035	.0007
72° 32"	.001	.0003	.0006
75° 31"	.001	.00025	.0005
78° 27"	.001	.0002	.0004
81° 22"	.001	.00015	.0003
84° 15"	.001	.0001	.0002
87° 8"	.001	.00005	.0001

TDJ SHOP DATA SHEET NO. 43

Approximate Blank Diameters for Drawn Shells (inches)

SHELL DIAM. (inches)	DEPTH OF DRAW (inches)				
	10.00	10.50	11.00	11.50	12.00
3.125	11.61	11.88	12.13	12.39	12.64
3.250	11.86	12.13	12.39	12.65	12.90
3.375	12.10	12.37	12.64	12.91	13.17
3.500	12.34	12.62	12.89	13.16	13.43
3.625	12.57	12.86	13.14	13.41	13.68
3.750	12.80	13.09	13.37	13.65	13.93
3.875	13.04	13.33	13.62	13.90	14.18
4.000	13.26	13.56	13.85	14.14	14.42
4.125	13.49	13.79	14.09	14.38	14.66
4.250	13.72	14.02	14.32	14.61	14.90
4.375	13.93	14.24	14.54	14.84	15.13
4.500	14.15	14.45	14.77	15.07	15.37
4.625	14.36	14.68	14.99	15.30	15.60
4.750	14.57	14.90	15.22	15.52	15.83
4.875	14.79	15.11	15.43	15.74	16.05
5.000	15.00	15.33	15.65	15.97	16.28
5.125	15.21	15.54	15.87	16.19	16.50
5.250	15.41	15.75	16.08	16.40	16.72
5.375	15.61	15.95	16.29	16.61	16.93
5.500	15.82	16.16	16.50	16.83	17.15
5.625	16.02	16.36	16.70	17.04	17.36
5.750	16.21	16.57	16.91	17.25	17.58
5.875	16.42	16.77	17.11	17.45	17.79
6.000	16.61	16.97	17.32	17.66	18.00

TDJ SHOP DATA SHEET NO. 44

Approximate Blank Diameters for Drawn Shells (inches)

SHELL DIAM. (inches)	DEPTH OF DRAW (inches)					
	.500	.625	.750	.875	1.00	1.125
6.250	7.18	7.39	7.60	7.80	8.00	8.19
6.500	7.43	7.64	7.85	8.06	8.26	8.45
6.750	7.68	7.90	8.11	8.31	8.51	8.71
7.000	7.93	8.15	8.36	8.57	8.77	8.97
7.250	8.18	8.40	8.62	8.82	9.03	9.22
7.500	8.44	8.66	8.87	9.08	9.28	9.48
7.750	8.69	8.91	9.12	9.33	9.54	9.74
8.000	8.94	9.16	9.38	9.59	9.79	10.00
8.250	9.19	9.41	9.63	9.84	10.05	10.25
8.500	9.44	9.66	9.88	10.10	10.30	10.51
8.750	9.69	9.92	10.13	10.35	10.56	10.76
9.000	9.95	10.17	10.39	10.60	10.81	11.02
9.250	10.20	10.42	10.64	10.85	11.07	11.27
9.500	10.45	10.67	10.89	11.11	11.32	11.53
9.750	10.70	10.92	11.14	11.36	11.57	11.78
10.000	10.95	11.18	11.40	11.61	11.83	12.04
10.250	11.20	11.43	11.65	11.87	12.08	12.29
10.500	11.45	11.68	11.90	12.12	12.33	12.54
10.750	11.70	11.93	12.15	12.37	12.59	12.80
11.000	11.95	12.18	12.40	12.62	12.84	13.05
11.250	12.20	12.43	12.67	12.91	13.09	13.30
11.500	12.45	12.65	12.90	13.11	13.35	13.56
11.750	12.66	12.92	13.16	13.39	13.59	13.82
12.000	12.96	13.20	13.42	13.63	13.86	14.07

TDJ SHOP DATA SHEET NO. 45

Approximate Blank Diameters for Drawn Shells (inches)

SHELL DIAM. (inches)	DEPTH OF DRAW (inches)					
	1.250	1.375	1.500	1.625	1.750	1 875
6.250	8.38	8.57	8.75	8.92	9.10	9.27
6.500	8.64	8.83	9.01	9.19	9.36	9.54
6.750	8.90	9.09	9.27	9.45	9.63	9.80
7.000	9.16	9.35	9.53	9.72	9.90	10.07
7.250	9.42	9.61	9.80	9.98	10.16	10.34
7.500	9.68	9.87	10.06	10.24	10.42	10.60
7.750	9.94	10.13	10.32	10.50	10.69	10.87
8.000	10.19	10.39	10.58	10.77	10.95	11.13
8.250	10.45	10.65	10.84	11.03	11.21	11.39
8.500	10.71	10.90	11.10	11.29	11.47	11.66
8.750	10.96	11.16	11.36	11.55	11.73	11.92
9.000	11.21	11.42	11.61	11.81	11.99	12.18
9.250	11.48	11.68	11.87	12.07	12.26	12.44
9.500	11.73	11.93	12.13	12.32	12.52	12.70
9.750	11.99	12.19	12.39	12.58	12.77	12.96
10.000	12.24	12.44	12.64	12.84	13.03	13.22
10.250	12.50	12.70	12.90	13.10	13.29	13.48
10.500	12.75	12.96	13.16	13.36	13.55	13.74
10.750	13.01	13.21	13.41	13.61	13.81	14.00
11.000	13.26	13.47	13.67	13.87	14.07	14.26
11.250	13.52	13.72	13.93	14.13	14.33	14.52
11.500	13.77	13.98	14.18	14.38	14.58	14.78
11.750	14.03	14.23	14.44	14.63	14.84	15.04
12.000	14.28	14.49	14.70	14.88	15.10	15.30

Modern Techniques Of Personnel Relations*

A group of able and loyal employees is the most important and valuable asset in any business. This asset must be constantly improved and not permitted to deteriorate.

Many companies spend thousands of dollars yearly on quality control for their product and still fail to realize that quality control of personnel pays large dividends as the result of loyal and thinking employees. If it is important to improve methods, maintain equipment and guard other assets, it is far more important to maintain quality personnel and improve the personnel asset.

by John D. Corrigan**

The effectiveness of other assets in a company depends entirely upon the effectiveness of personnel. The personnel policies of the company are the foundation for profitable operations in good or bad times.

Management can no longer afford to ignore the basic human relationship that must exist in its company if management desires to free itself from continuous labor trouble. Labor trouble is not necessarily a strike, but is the negative philosophy, thinking and opinions of the worker for management.

If employees believe that top management is composed of profiteers whose only objective is to exploit labor with no interest in the employees except what he can get out of them, there exists a constant source of labor trouble that reflects itself in high operating cost and low profits. The answer to this problem cannot be found in a method of expressing management's point of view to the employees. It can only be accomplished with a mutual understanding.

Another source is from the union negotiating committees who have sifted the information they want to pass along. Consequently, top executives in most companies do not have the correct facts upon which human relations policies, that will improve the quality of their personnel assets, can be formed. Almost without exception this is true in most multiple management corporations.

Certain techniques over a period of years have been developed by alert, ingenious and aggressive management executives. In any type of business the starting point to obtain the essential facts that will improve the personnel relations is first to determine the thinking of management and its attitude towards the employee. Next, it is important to gain an accurate and true opinion from the employee as to their thinking and attitude towards the company and its management.

This replaces belief with facts. Often it is necessary to change the thinking of management as the first step towards better human relationships. The second

*See "How To Build Labor Productivity" TDJ July 1945, p. 109.

**Corrigan, Osborne & Wells, Inc., Management Consultants

step is to eliminate employee suspicions. Their opinions are now known, and corrective procedures can be developed and put into effect as well as preventative measures to avoid recurrence. The third step is to eliminate inequities that exist in the wage and salary structure of the company and to establish definite wage policies which are known to the employees as fair and equitable. The problem of establishing these policies involves scientific job evaluation.

Job evaluation provides management with a factual yardstick for accurately measuring each job and establishing its value. Merit Rating then measures the employee as he performs the evaluated job. With Job Evaluation and Merit Rating, management has a measure of the quality of its personnel. The unqualified can be eliminated or placed in jobs according to their aptitude.

Merit Rating indicates the unfit or untrained person and he is no longer automatically promoted because of years of service. He must show aptitude, ability and initiative for up-grading and promotion. Promotion from within the ranks is the best morale builder a company can have providing the person promoted has sufficient initiative to acquire the skill necessary to properly perform his new assignment.

Management has three devices which it can use to improve the quality of its personnel. When these management techniques are installed and operating, management will find that:

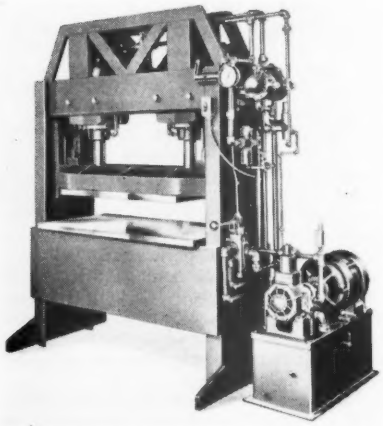
1. It knows the trend of employees thinking about the company and can constantly strive to improve that trend which results in better human relationship.

2. It has a high quality group of able, loyal and thinking employees as a foundation for a healthy growth.

3. It has a better understanding with the union because union contracts will be based on factual data which both union and management recognizes as basic and fundamental.

Modern management technique in human relations will maintain a high degree of employee morale which will result in low-cost production and higher profits. Improving personnel relations is a profit making activity.

KRW Press Designed for Light Weight, Low Cost



Conforming to postwar trends toward lighter and more efficient production tools, this new K. R. Wilson 80-ton Blanking and Forming Press represents a substantial reduction in both tons and dollars as compared to previous press designs of this type.

Its additional features of flexibility and simplicity in basic design are resulting in an appreciable shortening of manufacturing and delivery schedules.

The KRW press was designed for blanking, stamping and forming in metal; for cutting cloth, rubber, asbestos and similar fibrous materials with steel rule dies, and is also adaptable to the compression molding of rubber, plastics or ceramics.

The adjustable stroke that is practical with this hydraulic press contributes to its high rate of production. The platen may be stopped and reversed at any point in its travel. The smooth steady pressure of the hydraulically powered platen results in long die life. INFORM-A-GRAM Key No. 77-O.

INDUSTRIAL DIGEST

Science • Research • Methods • Tooling • Production • Trade News and Reports

Expanded Special Tooling Programs

A marked trend throughout the country toward expanded special tooling programs was reported to the directors of the National Tool and Die Manufacturers Association by President Richard F. Moore, at a recent Boston meeting. This trend arises largely from the need for cutting labor costs, and is particularly noticeable in the case of specially built machines, said Mr. Moore, who is also president of the Moore Special Tool Company, Inc., Bridgeport, Conn.

By installing one special-purpose machine to perform a number of operations previously done on separate machine tools, the manufacturer can replace the several employees formerly needed, by a single man. More complex special tooling is also being utilized to slash labor costs through the use of one progressive or compound die in the place of several simple dies.

Excellent results from the apprenticeship training program of the NTDMA were reported to the Board by Willis Ehrhardt, partner, Ehrhardt Tool and Machine Company, St. Louis, vice-president of the Association and chairman of its Fact-Finding Committee. In a recent survey, 280 typical tool and die shops throughout the country stated that they are training 1,111 apprentices. Of these, 3 out of every 4 are veterans. Extension of present apprenticeship programs promise eventual relief from the current shortage of tool and die makers, die sinkers, and men of like skill.

Much attention is being given by the Association to developing a set of principles of business conduct, aimed at establishing standards of fair practice in keeping with the special services rendered by tool and die manufacturers, as production consultants. A progress report on this was submitted by O. J. Grandahl, general manager of the Grandahl Tool and Machine Company, Hartford, Conn., and chairman of the Committee on Business Conduct.

Copper Alloy Steels

That the excellent casting characteristics and high physical properties, which can be developed in both light and heavy sections, should make copper alloy steels of interest for postwar castings is evidenced by wartime research on copper alloy steel castings at the U. S. Naval Research Laboratory by Taylor, Bishop and Wayne.

Low alloy copper-bearing cast steels are particularly useful for light weight castings, these researchers say, since the addition of copper increases the ratio of yield strength to tensile strength without materially affecting ductility. If manganese and silicon are added in above normal amounts, even better properties are obtained.

Other advantages pointed out in their report include:

1. Alloy steels containing more than 0.6 percent copper may be precipitation hardened without liquid quenching to increase yield and tensile strength still further. These steels have low impact resistance, but good elongation and reduction of area. Sections as large as eight inches can be hardened throughout by a precipitation strengthening draw after normalizing.

2. Copper alloy cast steels containing not more than 0.20 percent carbon show good weldability. If they contain about 0.10 percent carbon and have a yield strength above 50,000 pounds per square

inch, they are readily weldable without preheating or post-heating treatment.

3. A combination of copper and one percent or more of silicon results in excellent fluidity and prevents the steel from becoming brittle at subzero temperatures.

4. Copper alloy steels are more resistant to scaling during heat treatment than are plain carbon or molybdenum steels.

Though increased use of copper alloy steels was not feasible during the war, researchers Taylor, Bishop and Wayne thought it worth while to present the case for wider use of copper steel castings in post-war industry. They checked the work done by other investigators on heat treatment and physical properties of copper steels, and made additional studies of weldability, mass effect and high- and low-temperature properties of these steels.

Webber Acquires Control of Carblox Gage Blocks

The entire stock and production rights of the "CARBLOX" (Carbide Gage Block) division of the Lincoln Park Industries of Detroit have been acquired by the Webber Gage Company of Cleveland.

George D. Webber, President of Webber Gage Company, who was instrumental in this move, says the addition of "CARBLOX" has been long sought in his determination to combine all the advantages of steel and carbide.

The rise of the Webber Gage Company goes back twenty years when block gages were still laboratory devices, difficult to make and so high in cost that many sets of gages were literally kept in safe deposit vaults and handled as if worth their weight in gold.

Webber was singularly successful in bringing down costs of gage blocks so that even a small tool shop could well afford a complete set. "The secret to lower gage costs," says Webber, "was not lack of skill but inability to apply equipment and control devices successfully."

So important are these applications that the business of gage making is still a closely guarded secret.

Widespread use of gages has made possible the idea of interchangeable manufacture. The miracle of many small parts, originating from widely scattered shops converging into perfect assembly of a plane or tank or ship with dimensional accuracy of .0001", is one of the remarkable accomplishments of this decade. The difficulties would have been insurmountable without a master yardstick that could always yield the same result in plants located from Maine to California.

The hard surfaces of cemented carbides are important accessories to the more acceptable thermal qualities of steel. Used together they greatly extend the accuracy and service life of gages.

The addition will eliminate frequent necessity of checking or replacing worn blocks. Carbide's high cohesion also eliminates difficulties sometimes encountered in wringing thin steel blocks.

28th Annual National Metal Congress and Exposition

Advance programs of the participating societies in the 28th Annual National Metal Congress and Exposition reveal that unusual interest is being displayed by authors of technical papers. Already, the program committee of the American Society for Metals reports that more than twice the normal number of papers have been submitted by members for consideration and possible presentation before the ASM sessions during the NMCE. The American Welding Society, the Iron and Steel Division and the Institute of Metals Division of the A.I.M.E., and the American Industrial Radium and X-Ray Society, also participating in the Metal Show, report unusual activities in the same field in preparation for the Atlantic City meetings.

NMCE exhibit space will be utilized to show many advancements in production and manufacturing techniques evolved during the past five years. Due to wartime security regulations, most new methods necessarily remained classified. Now, however, with the lifting of Army and Navy restraints, many of the

new methods will be revealed for the first time.

The Congress and Exposition will be held in the Municipal Auditorium, Atlantic City, November 18-22, 1946.

Carbide Tool Misconceptions and Benefits

Several erroneous beliefs about the limitations of carbide tools were proved, during the war, to have been psychological rather than actual in nature. Once these misconceptions were discarded, carbides quickly found a greatly increased field of usefulness. Whereas, not so many years ago, people asked, "*Can* we use carbide tools on this job?" the question now is, "*What kind* of carbide tools should we use?"

The most universal conception, perhaps, was that carbide tools could not be used successfully on old or worn machines. War production showed that older machines can be used successfully merely by tightening spindles and bearings, eliminating excessive vibration under actual operating conditions, etc., corrections any good maintenance man can make. In some instances negative rake tools can be made to compensate for backlash in the machine.

Another early misconception was that carbides are of no value in steel cutting. Today, of course, advantages of carbides are recognized as being of even greater importance in steel cutting than for other types of metal cutting. It is common knowledge that carbide tools were largely responsible for the greatly increased production of war material from all kinds of steel, including the hardest of its alloys and even cast armor plate.

General adoption of standard carbide tools has exploded the myth that all carbide tools had to be specifically designed for each new application. Standardization of grades, tool forms, and cutting angles has progressed so far that an estimated 60% to 80% of all single point turning, boring, and facing operations can be handled with ten standard tool types.

A most persistent misconception was that carbide milling cutters would not work satisfactorily on steels. Yet one of the most remarkable advances in metal cutting in the past few years is along this very line. Steels of 170 to 200 Brinell are being milled regularly at 500 sfm and even higher. Steels of 450 Brinell are being milled at 250 sfm and higher. On certain applications, aluminum is being milled at speeds upwards of 12,000 sfm. Available spindle speeds seem to be the main limiting factor as far as cutting speed is concerned when milling aluminum alloys, rather than anything inherent in carbides.

As for the belief that carbide tools are extremely difficult to resharpen, it has been learned that carbides are *not* difficult to grind if proper equipment is provided and normal care is taken by the operator. Installation of central grinding rooms where trained operators run the grinders used for carbides has helped cure bad grinding practices.

As to the cost, it is true that at one time carbides were somewhat more expensive *per tool* than conventional tools although lower *per piece* produced. Today, the original cost of carbide standard tools actually compares favorably with the cost of other cutting tools. In general, the larger the tool the more favorable the cost comparison. Moreover, the longer production life of carbides makes the machining cost per piece far below the cost when machined with other cutting tools.

With the elimination of these and other misconceptions carbide tools have become generally accepted throughout the metal cutting industry for practically every kind of metal job and also for machining wood, plastics, concrete, etc. It is estimated that better than half of all "metal removed" in this country is machined with carbides today.

However, the limit of the effective use of carbides has not yet been reached. So far, all that we have done is to learn that carbide tools, correctly used, are simple to apply and will cut production costs amazingly. At the same time we have also learned more about the proper use of high speed steel tools because good carbide practice also constitutes good high speed steel tool practice.

(A communication from Harry Crump, Chief Tool Sales Engineer, Carboloy Company.)

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- **Heel Clamps**
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- **Hand Knob Clamp Assemblies**
- **Hand Knob Clamps**
- **Hex Jig Feet**
- **Jig Feet**
- **Knob Shoe Assemblies**
- **Mill Fixture Bases**
- **Quarter Turn "Lightning" Clamps**
- **Quarter Turn Screws**
- **Rectangular Box Jigs**
- **Square Box Jigs**
- **Stud Drivers**
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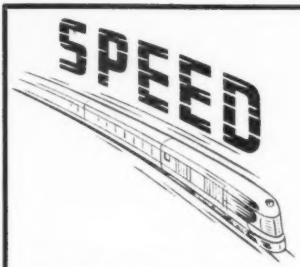
- **Swing Clamps**
- **Spherical Washers**
- **Socket Head Shoulder Screws**
- **T-Angle Plate Fixtures**
- **Precision V Blocks**



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The "Unbrako" Socket Cap Screw has a knurled head which provides a non-slip and fumble-proof grip even for oily fingers, so it can be screwed-in farther and faster before it becomes necessary to use a wrench, and, as is now generally recognized, its quality is tops*. In sizes from No. 4 to 1½"; full range of lengths. Write for the "Unbrako" Catalog.
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FOR FURTHER INFORMATION FILL IN KEY NUMBERS ON POSTAGE-FREE INFORM-A-GRAM INSERT

CHECKING GEARS AFTER PROCESSING, determining lead compensation for "unwinding" of gears during heat-treat, and aiding in setting up gear cutting and finishing machines are some of the features of a new line of production lead comparators recently introduced. The machines are applicable to both external and internal gears as well as worms. Complete detailed information and specifications are available from MICHIGAN TOOL CO., Dept. 47, 7171 E. McNichols Rd., Detroit 12, Mich., or use INFORM-A-GRAM Key No. 47-O.

CYLINDRICAL AND INTEGRAL GRINDING can be performed on the new No. 6 Excel Grinder. With the available attachments, sharpening reamers and milling cutters of a wide variety of shapes and sizes is facilitated. Some of the applications possible are well illustrated in Bulletin 5-45 which also describes the Excel Universal Cutter and Tool Grinder. Complete information will be furnished on request by COVEL MANUFACTURING CO., Dept. 742, Benton Harbor, Mich., or use INFORM-A-GRAM Key No. 742-O.

QUIET OPERATION, extremely high efficiency, long life, minimum maintenance costs, and working pressures to 1000 psi continuous, or 1500 psi intermittent, are features of the new Barnes Equalized Roto-Blade Hydraulic Pump. This combination of features effects a major savings in the initial cost of a hydraulic system through the simplification of circuit design and greater compactness in space required for a given speed and power. Complete data sheets and installation drawings will be furnished on request to JOHN S. BARNES CORP., Dept. 38, 301 So. Water St., Rockford, Ill., or use INFORM-A-GRAM Key No. A38-O.

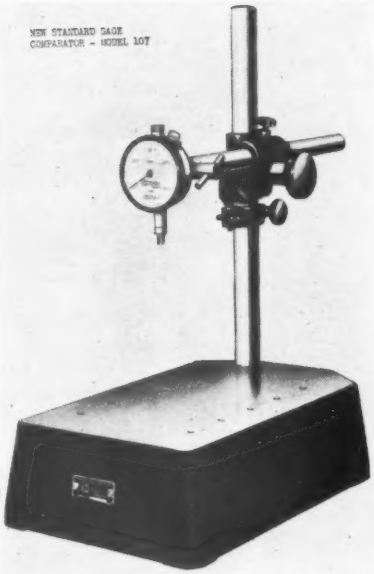
INDICATOR DIAL INSPECTION PROCEDURE is stepped up with a new dial comparator recently announced. Its flexibility is due to the extensible indicator support arm and the tapped holes in the platen for securing the work. By means of a double clamp arrangement the indicator support arm may be slid up or down on the vertical column, swung to any angle in either horizontal or vertical plane, and moved to place the indicator at the desired distance from the column. For full specifications write STANDARD GAGE CO., Dept. 78, Poughkeepsie, N. Y., or use INFORM-A-GRAM Key No. B78-O.

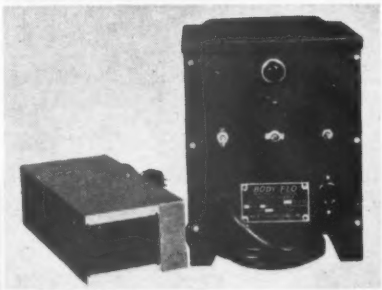
ON PARADE

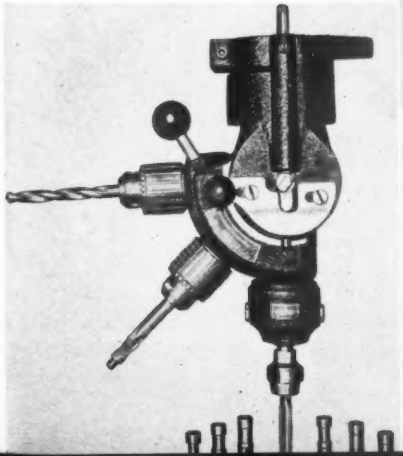
NEW POSSIBILITIES FOR MILLING OPERATIONS are offered through the Heavy Duty Body Flo Magnetic Chuck. Using climb or down milling with non-magnetic carboloy or carbide-tipped cutters, magnetism offers a simple solution to clamping problems in milling operations. The power unit for this chuck incorporates a power selector for stepping up the current, thereby increasing the magnetic holding power. Complete details on this equipment is available from MAGNETIC HOLDING DEVICES, INC., Dept. 783, 2034 East 22nd St., Cleveland 15, Ohio, or use INFORM-A-GRAM Key No. 783-O.

HOLDING ALL STRAIGHT OR TAPER SHANK TOOLS from $\frac{1}{16}$" to and including 1½" dia for grinding is now possible with a recently developed indexing head. This is an accurate, calibrated tool holder for resharpening or grinding taps, counterbores, end mills, miller cutters, reamers and lathe tools to any simple or compound angle. Adjustment for size is accomplished by use of adaptors and collets. Full information will be sent on request from GRINDERS & FIXTURES, INC., Dept. 82, 1255 West 4th St., Cleveland 13, Ohio, or use INFORM-A-GRAM Key No. A82-O.

DRILLING AND TAPPING IN ONE OPERATION at the same station can be accomplished with a three-position Drill Press Turret Head and a reversing tapping head incorporated in one of the three positions. The tapping unit fits all popular model drill presses, in addition to being adaptable to turret heads previously built by THE UNIVERSAL ENGINEERING CO., 2230-32 National Ave., San Diego 2, Calif. Detailed specifications will be sent by ad-

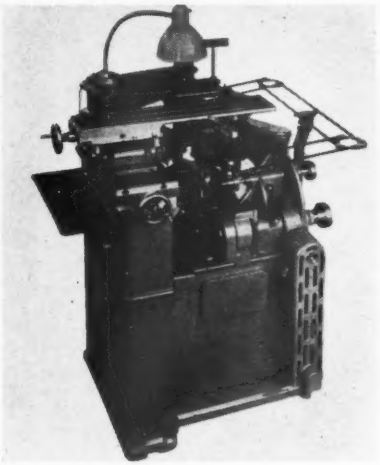






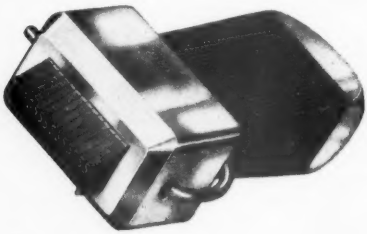
dressing the company, Dept. 25, or use INFORM-A-GRAM Key No. 25-O.

GRINDING PROFILES OF HARDENED WORK PIECES, such as profile gages, form tools, and sectional dies are operations performed on the Fritz Studer Ltd. (Switzerland) Profile Grinding Machine. The principle of operation consists in following the form of a template, enlarged in suitable proportion, by means of a tracer finger swiveling about its



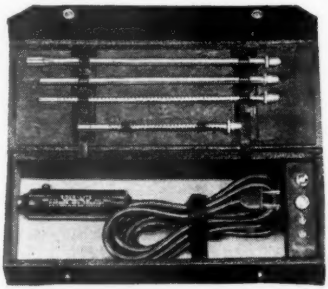
point. Linear movements are transmitted to the grinding wheel head through the pantograph and swiveling movements by turning the wheel about its cutting edge through link bars. Details and literature will be sent on request from COSA CORP., Dept. 250, 5000 Chrysler Bldg., New York 17, N. Y., or use INFORM-A-GRAM Key No. 250-O.

STAMPING BRAND NAMES, lot and serial numbers on etched plates, silverware, tools, checks, tags, machine parts, or stock numbering metal bars and sheets, are some of the functions of the light weight Utility Marking



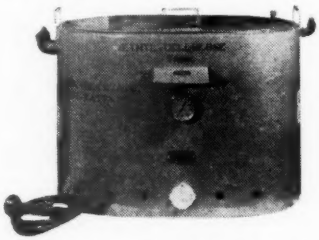
Outfit made by Cunningham. Made from Cunningham patented "Safety" steel, the Utility holder neither spalls nor mushrooms. Detailed information on this holder will be sent on request from M. E. CUNNINGHAM CO., Dept. 170, 104 E. Carson St., Pittsburgh, Pa., or use INFORM-A-GRAM Key No. 170-O.

INTERIOR INSPECTION OF CYLINDERS, gear housings, tubes, rifle barrels, pipes, and other such articles with minimum openings of



$\frac{3}{16}$" is facilitated with the Eder-Lite. Small light reflecting and glareless, metal projected tungsten bulbs attached to flexible or rigid extension make clear vision possible by literally steering them down the proper channels so that a maximum amount of light is focused on the proper place. For a completely descriptive folder about the Eder-Lite write to HARMON & CO., Dept. 13, 6 N. Michigan Ave., Chicago 2, Ill., or use INFORM-A-GRAM Key No. G13-O.

OIL JACKETED HEATING TANKS are now available for heating the ethyl cellulose (plastic) dip compounds used to protect precision



tools against rust, corrosion and breakage. With a dipping temperature of 350° F being required by these compounds, their volume of heat must be uniformly maintained throughout the dipping bath. It easily holds parts for plastic dip immersion such as gears, fittings, springs, locks, bushings, machine parts and precision tools. These tanks are marketed

New

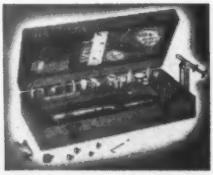
PRECISE 40

1/5 H.P.
and
40,000
R.P.M.

GRINDS
MILLS
DEBURRS
ENGRAVES
POLISHES
FINISHES

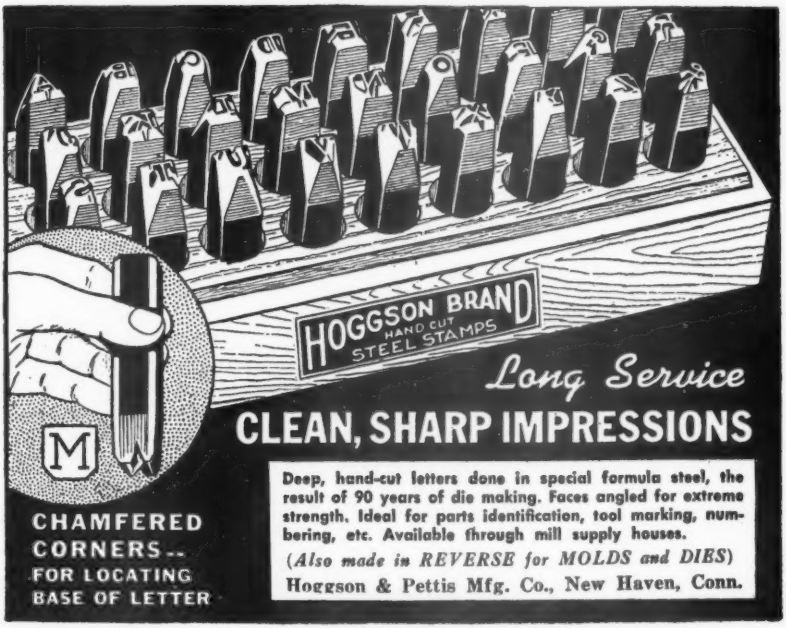
USE ON STEEL, IRON, BRASS, BRONZE, PLASTIC, WOOD AND OTHER MATERIALS.

Speed with power with precision—that's the new PRECISE 40. Surpasses our own PRECISE 35 which outworked every tool in the field. In strong, light plastic case, PRECISE 40 weighs only 40 oz.—packs a record 1/5 H.P. New type quill mounts precision collet chuck or grinding wheel arbors of various sizes; push-button spindle lock for quick tool change. 90% greater cooling; four oversize ball bearings. Quickly lubricated by pressure gun through ball-valve inlets. Tool mounts in vise, lathe, stand, or milling machine or can be used with PRECISE accessories for special applications. Guaranteed shockproof without ground wire.



SEND FOR IT — PRECISE PRODUCTS CO. 1341 CLARK ST., RACINE, WIS.

PRECISE 40



Long Service

CLEAN, SHARP IMPRESSIONS

CHAMFERED CORNERS -- FOR LOCATING BASE OF LETTER

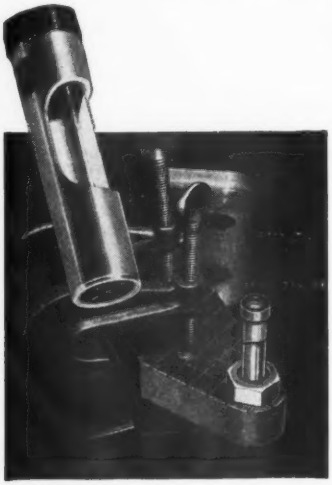
Deep, hand-cut letters done in special formula steel, the result of 90 years of die making. Faces angled for extreme strength. Ideal for parts identification, tool marking, numbering, etc. Available through mill supply houses.

(Also made in REVERSE for MOLDS and DIES)

Hoggson & Pettis Mfg. Co., New Haven, Conn.

by THE D. C. COOPER CO., Dept. 89, 1467 So. Michigan Ave., Chicago 5, Ill. Use INFORM-A-GRAM Key No. G89-O.

ACCURATELY LOCATING TEMPLATES in proper relation to workpieces is one of the functions of the Opti-Setter. This is a small, convenient, low cost optical centering tool, of value wherever drilling operations are performed. It also centers drill jigs to reference marks or to layouts, and can be used in special setups for measuring between points, workedges or reference lines. Machinists, setup foremen and home craftsmen will find it equally convenient on individual jobs as well as production applications. For detailed specifications write THE BENTON CO., Dept. T, 351 South La Brea Ave., Los Angeles 36, Calif., or use INFORM-A-GRAM Key No. G18-O.



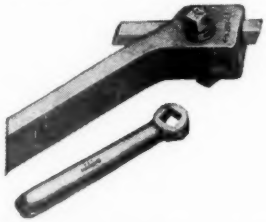
SOLID CARBOLOY BLADES for face milling cutters require only one type of body for machining any and all materials. The only variation is in the angles, which can be quickly ground for any specified material. The solid carbide blade is held in the head or holder by means of a sturdy wedging device which permits the blade to be adjusted for wear, thus insuring the use of the maximum portion of the blade. SUPER TOOL COMPANY, Dept. 168, 21650 Hoover Rd., Detroit 13, Mich., will send complete specifications. INFORM-A-GRAM Key No. 168-O.

LOAD CENTERING TYPE EYE BOLT. One hundred percent more weight than the load carried by ordinary eye bolts can be held by the Schaffer Load Centering Eye Bolt. By lifting in line with the load, as shown herewith, this bolt prevents fatal accidents, costly damage to machinery and other casualties.

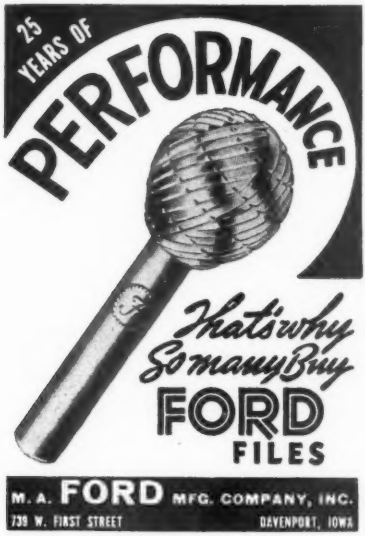
NEW SCHAFFER EYE BOLT OLD EYE BOLT

These bolts are produced by S. S. SCHAFFER & CO., Dept. TD, 4211 South Alameda, Los Angeles 11, California. INFORM-A-GRAM Key No. G45-O.

UNIVERSAL PRECISION TOOLHOLDER simplifies and speeds up machining operations by performing the work of 10 different toolholders. Since the bit openings are in line with the center line of the holder, the bit can be removed for regrinding and then replaced without disturbing the setting of the holder in the tool post.



ELK TOOLS, INC., Dept. DJ, 198 Church St.,



M. A. FORD MFG. COMPANY, INC.
739 W. FIRST STREET DAVENPORT, IOWA

DIE CASTING TOOL ENGINEER

Immediate opening for a man to take complete charge of die cast die designing department. Must be qualified by considerable experience to supervise designing of die casting dies. Experience with aluminum and zinc casting die design desirable. Must be able to coordinate between sales and production departments and customers. Large well established manufacturer of electrical appliances located in N.E. Ohio. Living conditions good in small town or medium size city. Address replies giving complete personal and work history to Box No. JP-367.

SIMPLY INSERT OPTI-SETTER in drill jig, align cross lines to work layout, clamp drill jig, remove OPTI-SETTER, and drill!

OPTI-SETTER Eliminates centering errors when drilling to layouts.

▶ Retains accuracy of original layout, whether machine drilled or drilled by hand.

▶ A handy, low-cost tool with dozens of applications in every shop on drilling, measuring and inspection problems!

FREE FOLDER ▶ describes Opti-Setter and uses. Write for your copy!

THE **BENTON** CO.
DEPT. T, 351 S. LA BREA AVE.
LOS ANGELES 36, CALIF.

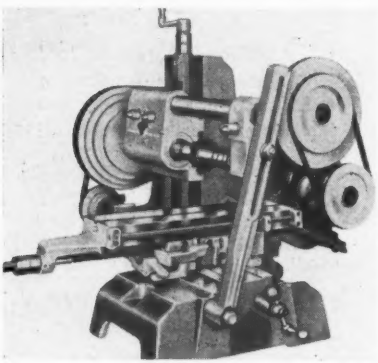
MANUFACTURERS OF OPTI-TOOLS

New York 13, N. Y., will send additional details on this flexible toolholder. INFORM-A-GRAM Key No. 852-O.

NEW PORTABLE ARC WELDERS or Zipper-ets, are now produced by MID-STATES EQUIPMENT CORP., Dept. DJ, 2429 S. Michigan Ave., Chicago 16, Ill. Zipper-ets are especially recommended for light duty welding, general maintenance, home workshop use, and all jobs outside the capacity of high amperage, heavy duty, industrial welders.

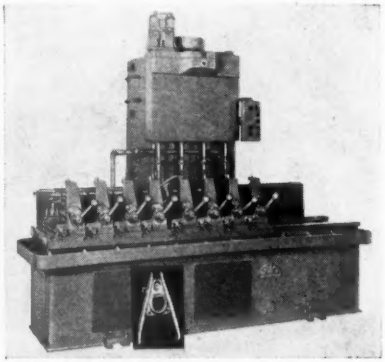
The Zipper-et is contained in a heavy gauge metal case, carried by a securely mounted top handle. INFORM-A-GRAM Key No. 393-O.

ACCURATE AND HIGH SPEED PRODUCTION, and intricate tool work can be performed on the Armor milling machine, which is built to aircraft specification and is especially suited to machine shop needs because of its adaptability to do several jobs. The



horizontal spindle nose is designed with external standard lathe threads for lathe operations, such as mounting chucks and face plates. For detailed specifications write AIRCRAFT MACHINERY CORP., Dept. 176, Burbank, Calif., or use INFORM-A-GRAM Key No. 176-O.

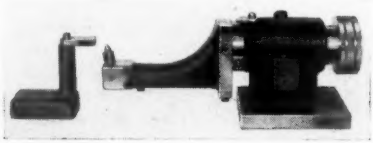
TAPPING BRACKETS, used in automotive front wheel supports, on the Snyder "SPECIAL" 4-Spindle Tapping Machine, are illustrated here. The table's eight fixtures provide



for four brackets being loaded while the remaining four brackets are being tapped. From the loading to the operating positions, both the table and its fixtures are hydraulically operated by means of equipment housed in the machine base.

For detailed information, write SNYDER TOOL AND ENGINEERING CO., Dept. 4-66, 3400 E. Lafayette St., Detroit 7, Mich., or use INFORM-A-GRAM Key No. 466-O.

DRESSING GRINDING WHEELS with the Jo-Set Radius Dresser requires only three simple steps to set up: set point of diamond to movable gage; set radius by inserting gage block



between stop and job; and set stops. A hardened and ground master gage maintains center of axis for life of tool, eliminating the need for indicators, micrometers, feelers, etc. The holder has an independent adjustment to correct any error in diamond tool. The Jo-Set dresses the wheel where it grinds. Descriptive literature is available from JAMES H. CROSS COMPANY, Dept. 96, 2765 West 8th St., Erie, Pa. INFORM-A-GRAM Key No. H96-O.

NEW! ROLLER LAPPING MACHINE CUTS LAPPING COSTS

$295 F.O.B. Chicago Less Motor

NO SPECIAL CHUCKS, COLLETS OR SET-UPS

Roller lapping gives superior results . . . saves time, labor and spoiled material on all lapping and polishing jobs. Eliminates numerous time-consuming operations —work can be checked at any time without stopping the machine.

Work is placed between two revolving different size precision ground cast iron rollers. A notched fibre stick is held against the work and moved evenly from side to side. Tapered rods or those with shoulders can be lapped almost as easily as straight ones. Work up to 6" in diameter may be accommodated.

ROLLER LAPPING IS FAST AND SIMPLE

Write today for complete details.

. . . . here are some of the many surfaces which can be lapped on the Spitfire Roller Lapping Machine.

Cylindrical Plug Gages	Die Bushings
Perforating Punches	Dowel Pins
Mold Core Pins	Taper Pins

SPITFIRE TOOLS, Inc.

2931 N. PULASKI ROAD • CHICAGO 41, ILLINOIS

SPECIFY Mac-its FOR STRENGTH, APPEARANCE, ECONOMY

Mac-its offer a complete line of heat-treated, alloy steel screws for the toughest kind of holding-down jobs. They're accurately made with die-cut threads, and heat-treated for the type of service in which they will be used. Sold through recognized distributors from coast to coast, and in Canada.

DISTRIBUTED NATIONALLY BY

STRONG, CARLISLE & HAMMOND COMPANY

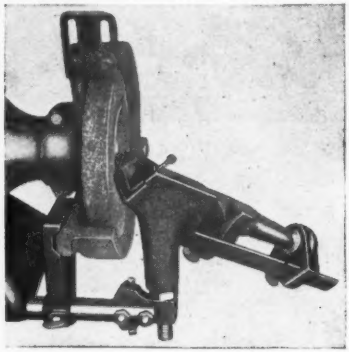
CLEVELAND 13, OHIO

MANUFACTURED BY

MAC-IT PARTS COMPANY LANCASTER, PA.

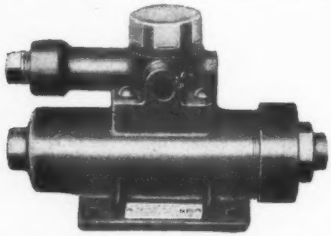
PROGRESS ON PARADE

DRILL GRINDING FIXTURES. Two Ind-L-Way models, which handle drills of all sizes from ¼" to 2⅞" dia and up to 26" long, are now available.



Ind-L-Way fixtures are usable with either bench and pedestal, Black and Decker and Van Dorn grinders or with others having the same dimensions. With the same efficiency as a more expensive grinder, a proper grinder equipped with an Ind-L-Way fixture precision grinds all kinds of drill points. Literature and detailed information are available from THE INDUSTRIAL MFG. CO., Dept. 48, 1900 Euclid Ave., Cleveland, Ohio, or use INFORM-A-GRAM Key No. G48-O.

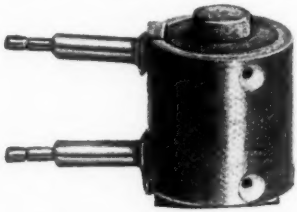
AUTOMATIC WATER EJECTORS, effective removers of water from compressed air systems, have been developed by NATIONAL PNEUMATIC CO., Dept. TD, 420 Lexington Ave., New York 17, N. Y. Besides preventing



water damage of pneumatic equipment or production material, the NP ejector maintains clean dry air, so that the efficiency of all air operated equipment is greatly increased. Write NATIONAL PNEUMATIC CO. for complete details, or use INFORM-A-GRAM Key No. G71-O.

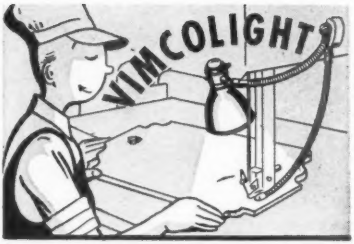
RIVET SPINNERS or Kern "Airflex" units for all types of cold head assembling, especially that of plastics, fibre, canvas, and insulating materials, are introduced by PLYMOUTH ENGINEERING CO., Dept. TD, Plymouth, Ind. Precise control of riveting force at maximum operating speed, which is effected

by its adjustable spindle regulator, increases this spinner-riveter's range for cold heading on either ductile or brittle materials. This unit's relatively narrow-faced tool contacts just a fraction of the rivet with each blow. INFORM-A-GRAM Key No. H48-O.



A RENEWABLE SWITCH, similar to a replaceable fuse, is now on the market. It is a plug-in type switch with two brass plugs which fit in sockets furnished with the set. Though its non-snap feature is not widely used by the makers, ROBERT HETHERINGTON & SON, INC., Dept. TD, Sharon Hill, Pa., they plan its incorporation in their entire line of switches. INFORM-A-GRAM Key No. F94-O.

A NEW 20" SHAPER of variable speed drive, provided with handwheel selectivity for an unlimited range of ram speeds, is announced by the SIMMONS MACHINE TOOL CORP., Dept. TJ, North Broadway, Albany 1,



DIRECT LIGHTING . . .

Cuts costs quickly by highlighting critical work areas for accurate, fast performance . . . exposes the danger points for added protection to operators. There is an adjustable VIMCO-LIGHT model available for every machine. Easy to attach . . . steady in any position.

On-the-spot lighting from any angle.

VIMCO
MFG. COMPANY, Inc. 117 BRAYTON ST. BUFFALO 13, N.Y.

M·B *MODEL M-CR 75,000 R.P.M.*

"JUNIOR" Pneumatic
GRINDER

This model has been engineered for applications where a small rugged tool can be used advantageously. Steel body for Safety. SPECIAL GREASE-SEALED BEARINGS, REQUIRING NO AUTOMATIC OR MANUAL LUBRICATION. Compound rotors develop an abundance of, power. Extremely lightweight, 12 oz. Whole length 5⅜", Length of body 3". Accommodates mounted grinding wheels, rotary files, etc., on ⅛" dia. shanks. Prompt deliveries.

REPRESENTATIVES IN PRINCIPAL CITIES

M·B PRODUCTS
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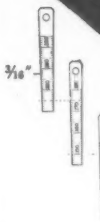
Detroit 26, Michigan



Keep track of hole sizes as you bore or grind

Now you can be sure of the *exact* size of trial cuts in bringing a hole up to size during boring or grinding. With a set of Moore *Direct Reading* Leaf Taper Gages, any hole size can be measured in infinite increments from .095" to 1.005". Simply insert the gage in the hole and read its diameter directly from the gage.

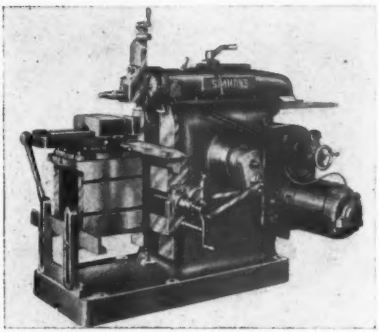
Each leaf in the complete set of thirty-six is a separate tool, accurate to .00025". It may be used individually without interference from any other gage. Graduations on each size overlap the next by .010"...enable measuring of counterbored or shouldered holes as well as the bottom of through holes to check for bellmouth or taper. Write today for detailed literature.

MOORE SPECIAL TOOL CO., INC.
726 Union Ave. • Bridgeport 7, Conn.

MOORE TOOLS

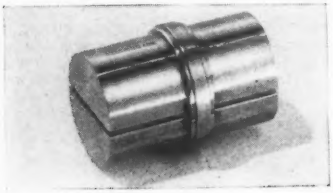
MOORE DIRECT READING LEAF TAPER GAGES

PROGRESS ON PARADE



N. Y. The Simmons Micro-Speed Shaper's performance is as dependable for heavy production demands as it is for the exacting requirements of tool room work. INFORM-A-GRAM Key No. 464-O.

CHUCKING AND UNCHUCKING WORK-PIECES without stopping the spindle of a screw machine or lathe equipped with a standard collet is a feature of the new Asco "Auto-Arb". This is an expanding arbor for

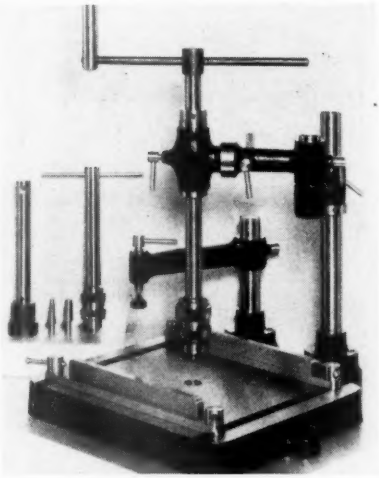


use on secondary operations where the workpiece is held by the inside diameter, and can also be used to good advantage on drill presses or milling machines with collet devices. It expands accurately, maintaining perfect concentricity with the collet. Complete description and illustration of operation setups are given in literature available from THE ASCO CORP., Dept. 13, 874 East 140th St., Cleveland 10, Ohio, or use INFORM-A-GRAM Key No. J13-O.

POSITIVE COUPLING OF DRIVING MOTORS TO DRIVEN UNITS, such as oil burners, air conditioning units and many other machines requiring maximum flexibility, is found in the new Lovejoy Flexible Coupling, CX Double-flex. This coupling cannot fall off when driving and driven units are separated. Of one-unit construction, the standard L-R body is permanently inserted into the molded synthetic rubber unit, this being permanently secured to the driven shaft by a set-screw.

Further details may be had by addressing the LOVEJOY FLEXIBLE COUPLING CO., Dept. 28, 5009 W. Lake St., Chicago 44, Ill., or use INFORM-A-GRAM Key No. 28-O.

PRECISION HAND TAPPING can be accomplished with the Allman Universal Tapping Fixture. Equipped with a positive grip tap



chuck, that grips the shank and square of tap, it eliminates a large percentage of broken taps, spoiled work and delay. It is fitted with a universal head for angle tapping and a spindle that has a quick action lock and collar to set the depth of thread. An inquiry to WOLCO TOOL DIVISION, Dept. 9, 721-25 Custer Ave., Evanston, Ill., will bring further details, or use INFORM-A-GRAM Key No. J9-O.

REMOVAL OF LEADER PINS AND BUSHINGS from die sets has been simplified through a new design by Baumbach. This consists of demountable leader pins and bushings which eliminates the necessity of pressing them into the die shoe and punch holder. After the bushings and leader pins are aligned, dowel pins are pressed into the flanges and they are then held securely in place by cap screws. Detailed information

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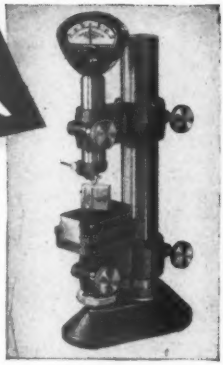

NO friction, lag or backlash . . . no racks, pinions, gears, levers, etc. subject to wear. Pointer responds instantly without swinging past true reading. Amplification is 100% mechanical, no lights or electromagnets, no warming up period required. Easily moved to different locations as there are no electrical connections. Our engineering department is at your service for applying Mikrokator to your measuring problem.

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It's raised and lowered, shifted and placed; transported about the shop. Tools and dies move too; and assemblies and stock! ● Many of these moves require the strength of two or more men, resulting in idle periods on the "helpers" machine and risk of strain and injury to all involved. ● Solve this problem with PORTELVATOR, the Hamilton Portable Elevating Table! Raises and lowers, transports and height adjusts. Heavy tools and materials are ROLLED from place to place, raised or lowered to desired position and SLID from Portelvator to work surface. Saves time, strain and effort. Enhances profits. ● Made in three standard models to lift and carry 1,000 to 5,000 pounds. Special models designed for "outsize" requirements. Write for literature and prices . . . Address Department C-P.

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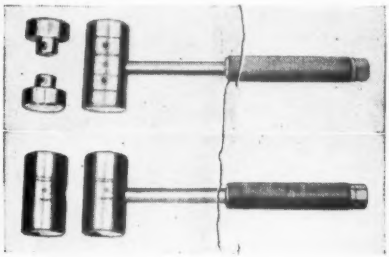
SUPER SENSITIVE DRILLING MACHINES · TAPPING MACHINES · PORTELVATORS

NINTH STREET AT HANOVER · HAMILTON · OHIO · U·S·A

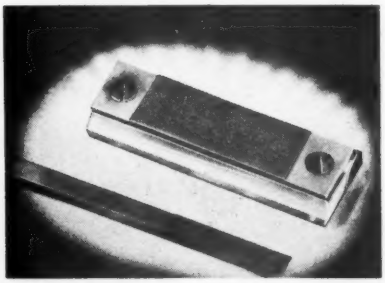
on these die sets will be found in Engineering Book No. 45, available on request from E. A. BAUMBACH MFG. CO., Dept. 14, 1812-22 S. Kilbourn Ave., Chicago 23, Ill., or use INFORM-A-GRAM Key No. J14-O.

PERFECT BALANCE SOFT HAMMERS in two new models shown herewith are announced by the GREGORY TOOL & MFG. CO., Dept. TD, 5300 Tireman, Detroit 4, Mich. Equipped with safety leather handles, these hammers are designed particularly for use in locomotive shops, tool and die shop heavy machinery assembling, etc. Each hammer is



available in any one of four weights from 4½ to 10 lbs with head diameters of 1¾", 2", 2¼", and 2½". These models differ only in their replaceable brass or copper parts, the head of one hammer, and the tips of the other hammer's case hardened steel head. INFORM-A-GRAM Key No. G63-O.

DIAMOND "R" FILES & HONES. Dressing carbide cutting tools without removing them from the machine is easily accomplished with these new tools. This so effects time lost in dismounting and setting up tools that production is materially increased. In the new and exclusive metal bond of these files and hones, a 100 concentrate of diamonds is contained. These tools are made by THE WENDT-SONIS CO., Dept. TD, Hannibal, Mo. INFORM-A-GRAM Key No. 518-O.



HACK SAW BLADE HOLDER. Utilizing broken blades is the handiest service of this Super Hack Saw Blade Holder. As a handle for old or broken cutting blades, it aids any craftsman or workman. Of utmost simplicity in design, this holder is a single unit, tubular handle with an extended, positive grip nose. This secures the blade or file working point while the slotted handle ends accommodate inserted blades.

Its distributor is A. D. McBURNEY, Dept. DJ, 939 West 6 St., Los Angeles 14, Calif. INFORM-A-GRAM Key No. F95.5-O.

DEEP GROOVING ABRASIVE WHEELS, bonded with Durez cast phenolic resin, are now produced by J. G. Sandstrom Grinding Wheel Co. In one operation, a Sandstrom wheel cuts as many as five finished grooves in an aircraft engine shaft. The required pre-

cision is possible with the Sandstrom wheel guaranteed tolerance of only .0005". This is a notable production accomplishment in view of all the complex factors contributing to fine grinding wheel composition. It should also be noted that grinding wheels of Sandstrom accuracy are bonded by Durez cast phenolic resin. It is one of those so almost universally adopted by the grinding wheel industry within the past 10 years. No doubt this is a result of industry's requiring so great a variety of grinding wheels, that they need nearly be tailor made for individual jobs. Consequently, formulating specially qualified bonds has been a major problem.

All developments in Durez resins have closely kept pace with those in the wheel producing industry. For further information on Durez resins, address DUREZ PLASTICS & CHEMICALS, INC., Dept. TJ, N. Tonawanda, N. Y. INFORM-A-GRAM Key No. B74-O.

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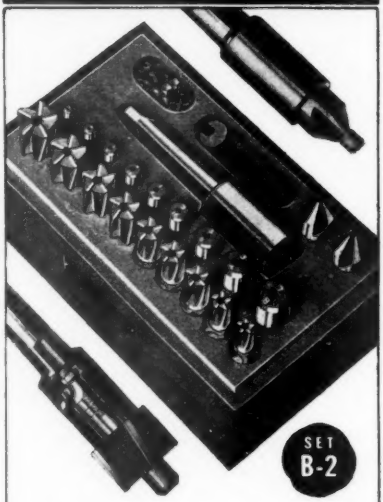
Roosevelt Park Box 478, Detroit 32, Mich.



Included are: one type B-2 holder; nine cutters from ⅜" to 1⅛"; nine pilots from ¼" to ⅞"; two ⅞" countersinks, one 70° and one 82°, in hardwood box with hinged cover.

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"LESSONS IN GRINDING" is a pamphlet which lists a series of 16mm Kodachrome motion pictures with sound, for use by industrial apprentice schools, foremen's groups, vocational schools and colleges wherever machine shop practice is being taught. They are short films running from 14 to 30 minutes each. The films include information on cutter sharpening, the cylindrical grinder, the surface grinder, the care and uses of grinding wheels, grinding carbide tools, grinding wheel markings, and grinding wheel safety.

Copies of this pamphlet may be secured from the Norton Company, Dept. 5-45, Worcester 6, Mass., or use INFORM-A-GRAM Key No. 545-O.

NEW DATA ON DIAMOND TOOLS. Much valuable engineering data on the proper application of diamond tools is available from The Precision Diamond Tool Company, Dept. DJ, 102 So. Grove Ave., Elgin, Ill. Their 20-page catalog contains instructions on standard grinding wheel dressers with engineering data for selecting the proper diamond for a specific job. The correct and incorrect method of dressing wheels is illustrated by suitable drawings.

A wall chart containing engineering data, reprinted from pages 2 and 10 of the catalog, on the use of diamond wheels and wheel dressers, is also available. INFORM-A-GRAM Key No. G40-O.

A NEW DECIMAL EQUIVALENT CHART, 9" x 11" in size, is now ready for distribution by Rutland. These charts may be had upon request on your company's letterhead from Rutland Tool Service, Dept. 16, 13006 Greely Ave., Detroit 3, Mich., or use INFORM-A-GRAM Key No. A16-O.

HOW TO SELECT THE RIGHT ELECTRODE for welding different types of stainless steel is discussed in a new folder by Jessop Steel, titled, "Stainless Steel Welding Electrodes". In welding stainless steel, strength and corrosion resistance comparable to those of the metal being welded must be maintained as closely as possible in the weld. The fact that both rod and base metal undergo certain changes when heated to welding temperature, makes the choice of the proper rod an important procedure. By use of tables and recommendations, the solution to this problem is explained. Copies of this folder will be furnished on request by Jessop Steel Co., Dept. 259, Washington, Pa., or use INFORM-A-GRAM Key No. 259-O.

MACHINING STAINLESS STEEL by turning, drilling, tapping, threading, milling, broaching, reaming, filing and sawing is treated in a new "Notebook" by Carpenter Steel. Each type of cutting tool is illustrated with the correct back rake, relief, and clearance angles given. Also, a check chart for each type of tool is incorporated, listing the possible tool troubles which can occur and their corrections. The handbook is well illustrated with photographs and diagrammatic sketches. Typical stainless parts are shown of stainless machining jobs that have been done at a profit in various plants. Production and management executives may secure their personal copies of the booklet free from their nearest Carpenter representative, with additional copies available at 50¢ a copy. The Carpenter Steel Co., Dept. 38, Reading, Pa.

"MACHINE SHOP OPERATIONS" presents a practical method for learning machine shop work by a study of actual jobs. This book, by J. W. Barritt and E. T. Larson, simplifies and shortens the training period by giving a comprehensive treatment of standard type jobs on use of measuring tools, laying out work, drill press, shaper, vertical and horizontal boring mills, lathe, planer, slotter, grinder, milling machines, bench work, floor work, automatic machines, and reading working drawings.

Jobs, typical of the hundreds of major operations a skilled mechanic is called upon to do, are listed, plus the tools required for each job. Each job is worked out in a step-by-step process. Questions appear at the end of each job.

This 867-page book with 1,337 illustrations has a durable, washable cloth, screw post binder and is available from the American Technical Society, Dept. DJ, Drexel Avenue at 58th Street, Chicago 37, Ill. Price $6.00.

THESE DRESSERS HAVE LAYERS OF DIAMONDS!

. . . eliminating unpredictability of single stones—each layer ready to go to work *instantly!*

For best results, at lowest cost, use Carboloy Diamond Impregnated Wheel Dressers. They give uniformly dependable performance, because their efficiency doesn't depend upon the unpredictable quality of *one* stone, but upon the average of *many*.

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INSPECTION OPERATIONS AND MACHINE SETTINGS BY DIAL INDICATOR is made clearer in the completely revised third edition of the Starrett Dial Indicator Catalog. It contains complete descriptions and illustrations of the many standard Starrett Dial Indicators together with information about other Starrett Indicators such as inside and depth dial gages, vibrometers, cylinder gages and dial gages for measuring the thickness of mate-

rials. For copies of this catalog write THE L. S. STARRETT CO., Dept. 6-99, Athol, Mass., or use INFORM-A-GRAM Key No. 699-O.

FINE GRINDING, LAPPING, AND POLISHING of dies and molds, precision parts and industrial jewels with Hyprez Diamond Compound is described in literature recently issued. This compound is a new prepared abrasive containing only finely graded, pure diamond powders of excellent quality. For copies of this literature write ENGIS EQUIPMENT CO., Dept. 939, 431 South Dearborn St., Chicago 5, Ill., or use INFORM-A-GRAM Key No. 939-O.

TEMPERATURE CONTROL IN SOLVING POWDERED METAL PRODUCTION PROBLEMS is discussed in "Wheelco Comments" for May 1946. Powdered Metal Production is explained and the important part Wheelco Capacitrols played in solving temperature problems at Powdered Metal Products Co. Copies of this bulletin are available on request from WHEELCO INSTRUMENTS CO., Dept. 72, Wheelco Bldg., Harrison and Peoria Sts., Chicago 7, Ill., or use INFORM-A-GRAM Key No. 72-O.

HEAVY GUN TUBES FROM SEAMLESS TUBING. Timken's new method of making heavy gun barrels from seamless steel tubing has resulted in enormous savings in time and materials. Copies of a booklet describing and illustrating this method may be obtained from TIMKEN ROLLER BEARING COMPANY, Dept. 5-73, Canton 6, Ohio, or use our INFORM-A-GRAM Key No. 573-O.

CHECKING ERRORS, involving pitch diameter, lead, taper, angle, out-of-roundness, and straightness, is performed with the Limitrol, a new comparator gage equipped with threaded rolls. This device can be quickly converted from bench to hand model, thus enabling the gaging of "work in progress" without disturbing the machine setup. N. A. WOODWORTH CO., Dept. 9-26, 1300 East Nine Mile Rd., Detroit 20, Mich., will send Catalog 44L upon request, or use INFORM-A-GRAM Key No. 926-O.

VERTICAL ADJUSTMENT OF BORING TOOLS in lathes is provided for in a new Bokum Tool Holder. Adjustments can be made quickly by means of a conveniently located knurled screw which moves the tool in a vertical plane to bring it to any precision setting. Catalog No. 464 will be sent on request from BOKUM TOOL CO., Dept. 43, 14775 Wildmere Ave., Detroit 21, Mich., or use INFORM-A-GRAM Key No. A43-O.

KEY WAY BROACHING by the Glenny method shows an increase in production of 10 times over the shaper method. This performance on a key way $\frac{3}{16}$" deep and $\frac{3}{8}$" wide in a steel bushing 1½" ID, 3" long is explained in Bulletin No. 10 issued by EAST SHORE MACHINE PRODUCTS CO., Dept. 144, 835 East 140th St., Cleveland 10, Ohio. This bulletin is available on request or use INFORM-A-GRAM Key No. 144-O.

LAYOUT AND INSPECTION of tools, dies, jigs, fixtures, castings, patterns, forgings, and

any layout or inspection work which may include angles or compound angles, is easily performed on the Model "G" Studler Angle Computer. This computer is described and illustrated in Bulletin No. 5, which is available on request from THE ANGLE COMPUTER CO., Dept. 100, 1709 Standard Ave., Glendale 1, Calif., or use INFORM-A-GRAM Key No. 100-O.

TESTING, SAMPLING, PROVING COLOR AND MOLDS are jobs performed on the Hi-Speed Plastic Injection Molding Machine. This machine augments more expensive machinery by doing the small, important testing work, thereby freeing the large molding machines for mass production. Literature describing this machine will be sent on request from MUNTON MANUFACTURING CO., Dept. 10, 9400 Belmont Ave., Franklin Park, Ill., or use INFORM-A-GRAM Key No. J10-O.

FINISHING STEEL with a rich, deep black, protective, penetrating finish by The Pentrate Process is interestingly described in a brochure published by Heatbath Corp. Numerous treated products are illustrated and one section shows the bath equipment and automatic controls. For copies, write HEATBATH CORP., Dept. 724, Front St., Springfield, Mass., or use INFORM-A-GRAM Key No. 724-O.

TIME-SAVING, LABOR-SAVING, AND CONVENIENT ATTACHMENTS for G & L Machines are clearly and pictorially described in a new brochure titled "Accessories and Attachments." The purpose, typical application, and structural feature of each attachment is given. G & L owners will be interested in this bulletin which is available on request from GIDDINGS & LEWIS MACHINE TOOL CO., Dept. 43, Fond du Lac, Wis., or use INFORM-A-GRAM Key No. 43-O.

TRANSFERRING GAGE BLOCK ACCURACY to work and inspection operations is accomplished through the George Scherr Gage Block Utility Set. The set contains holders, gage blocks, trammel points, jaws, and scriber, from which the required instrument can be made. This set is described and its uses explained in "Precision Production", available from the GEORGE SCHERR CO., INC., Dept. 4-90, 200 Lafayette St., New York 12, N. Y., or use INFORM-A-GRAM Key No. 490-O.

LOADING AND UNLOADING DRILL VISES is speeded up by the Grip-Master Screwless Vise. Clamping of the workpiece is done by an effortless push or pull on a center bar knob, then an easy press on the locking lever gives the jaws a tenacious grip. Description and applications of this vise are found in a recently issued folder, copies of which are available from the NATIONAL MACHINE TOOL CO., Dept. 46, Racine, Wis., or use INFORM-A-GRAM Key No. D46-O.

SAVING TOOLMAKERS' TIME is possible by using ground flat stock which eliminates the expensive machining operations needed to reduce mill stock to size. Capewell Precision Ground Flat Stock comes in thicknesses from $\frac{3}{32}$" to 1", in various widths and 18" lengths. Circular No. 1640D describes this stock, copies of which will be sent on request from THE CAPEWELL MANUFACTURING CO., Dept. 117, 60 Governor St., Hartford 2, Conn., or use INFORM-A-GRAM Key No. 117-O.

BROACHING TACKLES SOME NEW SURFACES, and some old ones in new ways in the automobile industry, is reported by Cincinnati Milling. Also, how form cutters can lead double lives is explained and illustrated in the March-April, 1946 "Report from Cincinnati Milling". Copies of this interesting material are obtainable on request from THE CINCINNATI MILLING MACHINE CO., Dept. 233, Cincinnati 9, Ohio, or use INFORM-A-GRAM Key No. 233-O.

DRILL BUSHINGS, conforming rigidly with ASA requirements, in the headless press fit, slip renewable, headless liners, head press fit, and fixed renewable types are listed in new literature issued by Products Engineering. Copies of Data Folder No. 8, covering these items are available without charge from PRODUCTS ENGINEERING CO., Dept. 158, 8511 Sunset Blvd., Los Angeles, Calif., or use INFORM-A-GRAM Key No. 158-O.

MAXIMUM PRODUCTION AT LESS COST, in machining operations, has been attained with Rex Tool Bits. This efficiency results mainly from carefully controlled processing of the bars for these bits. A folder titled, "Rex High Speed Tool Bits" explains the characteristics and applications of this brand of tool bit and gives suggestions for tool bit grinding. Copies will be sent on request from the CRUCIBLE STEEL COMPANY OF AMERICA, Dept. 2-56, 405 Lexington Ave., New York 17, N. Y., or use INFORM-A-GRAM Key No. 256-O.

TENSION AND WEIGHT MEASURING are now facilitated by a new remote indicating dynamometer known as Ten-O-Trol. The instrument is placed at the point where tension or weight is exerted and by means of flexible cable and repeater station instruments, readings can be made at remote locations. This equipment is clearly explained in literature issued by W. C. DILLON & CO., INC., Dept. 58, 5401 West Harrison St., Chicago 44, Ill., or use INFORM-A-GRAM Key No. A58-O.

FORMED WHEEL GRINDING in the production of gears and splines and the grinding machines used in producing them are described and illustrated in a brochure now available from GEAR GRINDING MACHINE CO., Dept. 42, Detroit 11, Mich., or use INFORM-A-GRAM Key No. B42-O.

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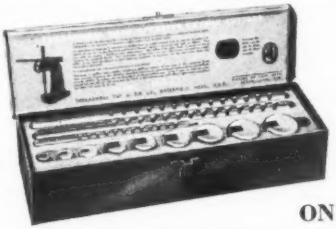

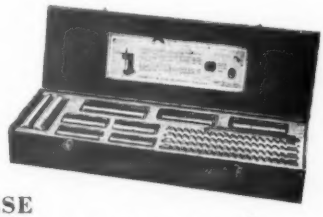

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You can cut any keyway in 60 seconds with one of these *Threadwell* Keyway Cutters.

All you have to do is drop in the bushing that fits the bore, put the broach in the bushing slot and press it through, once with the cutter and then again with the shim to give you the exact depth you want. One minute and you've cut a standard width keyway of any desired depth in a gear, collar, pulley hub, coupling, milling cutter, or what have you.

A *Threadwell* Keyway Cutter Set pays for itself in no time. Cutters may be used in any light arbor press but for most efficient operation use the Threadwell Arbor Press.

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complished with Ready-to-Use Emulsifying Degreaser, G-BEX-D. It will not hot strip paint or lacquer and may be used for degreasing by spray, brush or soak application followed by water rinse. Complete details will be sent on request from GAYBEX CORP., Dept. 14, P. O. Box 3-D, Nutley 10, N. J., or use INFORM-A-GRAM Key No. E14-O.

FEED, RAPID TRAVERSE, AND DIRECTIONAL CONTROL for milling machine operations are the functions of the one unit "Hydraulic Circuit Control" pump built by Sundstrand. A recently issued bulletin clearly explains and illustrates with photographs and drawings the operation and application of this pump. Copies are available on request from SUNDSTRAND PUMP DIVISION (SUNDSTRAND MACHINE TOOL CO.), Dept. 36, 2558 Eleventh St., Rockford, Ill., or use INFORM-A-GRAM Key No. 36-O.

ACCURACY REQUIRED IN TOOL MAKING, and the strength required in production work are incorporated in the line of standard, dial indexing, and compound rotary tables made by Stevens. These rotary tables are so constructed that there are no openings in the top, bottom or sides, therefore no dust or dirt can enter the gear and shaft housing. Descriptive literature will be sent on request from JOHN B. STEVENS, INC., Dept. 11, 480 Canal St., New York 13, N. Y., or use INFORM-A-GRAM Key No. J11-O.

SPOT WELDING FLANGED AND OVERLAPPED SHEETS of clean and coated carbon steels and stainless steels, as well as assemblies such as crates, metal office furniture, stoves, showcases, etc., is readily accomplished with the Taylor-Winfield Portable Spot Welder. Portable Bulletin 5-003 clearly describes and illustrates this line of welders, copies of which are obtainable on request from THE TAYLOR-WINFIELD CORP., Dept. 75, Warren, Ohio, or use INFORM-A-GRAM Key No. G75-O.

"PRODUCTS OF EATON". This illustrated booklet describes Eaton's principal peacetime products and their new products developed in their Research Laboratories. Some of their products include: single and 2-speed truck axles, engine valves, valve lifters and tappets, rotary pumps, coil and leaf springs, snap rings, cold drawn steel, and gray cast iron castings. Write EATON MANUFACTURING CO., Dept. 90, 739 East 140th St., Cleveland 10, Ohio, for a copy of this booklet, or use INFORM-A-GRAM Key No. H90-O.

MADISON-KIPP LUBRICATOR, Model SVD, is introduced in Bulletin L-3551, published by MADISON-KIPP CORPORATION, Dept. 86, Madison 4, Wis. Model SVD combines a liquid sight feed pumping unit with the exclusive Madison-Kipp direct channel oil distributor block. The FD distributor serves to direct oil through its outlets from the pumping unit. Copies of Bulletin L-3551 are available on request from the company or use INFORM-A-GRAM Key No. B86-O.

CROMOVAN DIE STEELS. The general applications of this steel include cutting and forming dies, such as trimming, blanking, stamping, cold forming, extrusion, drawing, etc. It is also recommended for some types of punches, rolls, gages, taps, reamers, lathe centers, spinning tools and other special operations where conditions are unusual. The Cromovan Bulletin giving analysis, technical data and applications is available from FIRTH-STERLING STEEL CO., Dept. 10, McKeesport, Pa., or use INFORM-A-GRAM Key No. 10-O.

FLOATING TAP HOLDER was designed to correct parallel and angular misalignment. Its construction permits the tap to float freely whether going in or out, and will not freeze under tension caused by drag of tap. Amount of float is infinitely variable and simply adjusted by a lock nut. EMPIRE TOOL COMPANY, Dept. 5-54, 8774 Grinnell Ave., Detroit 13, Mich., will send complete details, or use INFORM-A-GRAM Key No. 554-O.

FASTRAVERSE METAL WORKING PRESSES are described in Hydraulic Press' Bulletin 4206. These presses speed up production and cut manufacturing overhead by reducing the number of drawing operations. Their versatility of control permits easy and quick adjustment for the specific requirements of each job. Write THE HYDRAULIC PRESS MANUFACTURING CO., Dept. 3-28, Mount Gilead, Ohio, for a copy of this bulletin, or use INFORM-A-GRAM Key No. 328-O.

STUB SCREW MACHINE DRILLS are specifically designed and constructed for work requiring short, sturdy drills. They are made with short flutes and are properly heat treated to insure maximum tool life between grinds. A full range of wire gauge sizes from No. 1 to No. 60, and fractional sizes from $\frac{1}{16}$" to 2" are listed in a folder which can be obtained from CHICAGO-LATROBE TWIST DRILL WORKS, Dept. 5-67, 411 W. Ontario St., Chicago 10, Ill., or use INFORM-A-GRAM Key No. 567-O.

SPEEDING CONSTRUCTION, REPAIR AND METALWORKING OPERATIONS, involving surfaces that must not be marred, are described in Bulletin BE-12 issued by Green, Tweed & Co. The tool described is the soft faced Basa Hammer with the split-jaw construction and replaceable faces which do not shrink, expand, chip or disintegrate and are not affected by chemicals. For copies of Bulletin BE-12, write GREEN, TWEED & CO., Dept. 782, Bronx Blvd. at 238th St., New York 66, N. Y., or use INFORM-A-GRAM Key No. 782-O.

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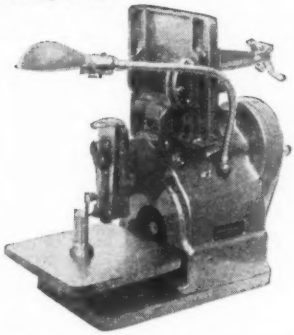
file inside Molds, Molding Dies, Blind Holes . . . . . file Flanged Punches, Templates, Cams, Keyways, Cutters, Dies.



DIE TABLE swings up vertically.

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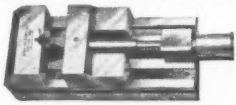

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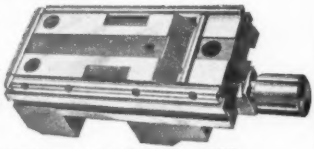

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PUBLICATION PREVIEWS

SECOND OPERATION MACHINING, Toolroom, Development, and Experimental work on small parts are handled with precision on the Gilman Jewelers Lathes. Literature pictorially describing these machines will be furnished on request by GILMAN ENGINEERING CORP., Dept. 12, Janesville, Wis., or use INFORM-A-GRAM Key No. J12-O.

REPRODUCTION OF DRAWINGS into Black and White prints and the advantages of different weights of paper stock for the finished prints is discussed in a folder published by Bruning. Copies of "The Bruning BW Process" will be furnished on request from CHARLES BRUNING CO., INC., Dept. 8-70, 4753 Montrose Ave., Chicago 41, Ill., or use INFORM-A-GRAM Key No. 870-O.

A BIG BOW COMPASS, with which circles of from $\frac{1}{16}$" to 8" in diameter are drawn, is introduced in literature by THE FREDRICK POST CO., Dept. T-8, 3650 Avondale Ave., Chicago, Ill. Setting Big Bow to any desired diameter is simply accomplished by mere finger-tip adjustment of the double action center thumb screw; a convenience and assurance of rigidity in bow instrument use. INFORM-A-GRAM Key No. 797-O.

SAFETY & RELIEF VALVES, matching the latest power and process equipment designs, are announced in catalog No. 45, just released by the FARRIS ENGINEERING CO., Dept. T-2,

400 Commercial Ave., Palisades Park, N. J. This booklet's easy-to-use pictorial index shows line drawings of all the Farris Valves, thus their selection is greatly facilitated. Copies of catalog No. 45 are available upon written request. INFORM-A-GRAM Key No. G84-O.

METAL FABRICATION SERVICES are described in an interesting, sixteen-page booklet made available by HUNGERFORD CORP., Dept. T-4, Big Flats, N. Y. The booklet's illustrations show equipment used by this corporation for cutting, forming, arc welding, oxy-acetylene welding and spot welding as well as for a variety of items which are produced to customer's specifications. INFORM-A-GRAM Key No. G20-O.

SPOILAGE OF SENSITIZED BLUEPRINT PAPER due to hot, humid weather conditions is now eliminated through a new method incorporated in the sensitizing process by Wing-Valentine Co. This new blueprint paper is the result of much scientific research that incorporates qualities no other blueprint paper has shown to date. Wing-Valentine Co., long in the field of paper manufacture, has established a new plant in Chicago for producing quality engineering papers including blueprint and tracing papers. Complete data will be sent on request from WING-VALENTINE CO., Dept. 17, 7120 North Clark St., Chicago 26, Ill., or use INFORM-A-GRAM Key No. J17-O.

MILLING, DRILLING OR BORING OPERATIONS at any desired angle are possible with the Fray Ram Type Vertical Universal milling machine. This machine is built expressly for firms wanting a precision tool on which both the cross and longitudinal movements of the head are definitely controlled. Literature describing this machine, also the "All-Angle" Milling attachment and Offset Boring Heads manufactured by Fray Machine Tool Co., is available from their natural distributor, the H. LEACH MACHINERY CO., Dept. 8-01, 387 Charles St., Providence 4, R. I., or use INFORM-A-GRAM Key No. 801-O.

ONE HUNDRED TWENTY THOUSAND SIZE GAGES, in steps of .0001", are possible with the Johansson Gage Block Set, No. 1, composed of 81 blocks. The blocks, accessories and applications are described and illustrated in a folder recently issued. Copies of this folder can be obtained by writing FORD MOTOR CO., Dept. 715, Johansson Division, Dearborn, Mich., or use INFORM-A-GRAM Key No. C715-O.

PRESS BRAKE DIES, which can be shaped and put to use without any further treatment, are made from Kromite No. 3, a Chrome-Moly-Nickel Steel. This steel, of special analysis, yields tremendous tensile strength, hardness, resistance to abrasion and vibration, while retaining free machinability. It is now available in sizes and shapes convenient for those industries which deal in shaping of sheet metal. Detailed information is given in a bulletin "Fool-Proof Industrial Steels" which will be mailed on request from ASSOCIATED STEEL CO., Dept. 15, 4545 Hough Ave., Cleve-

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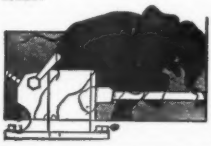

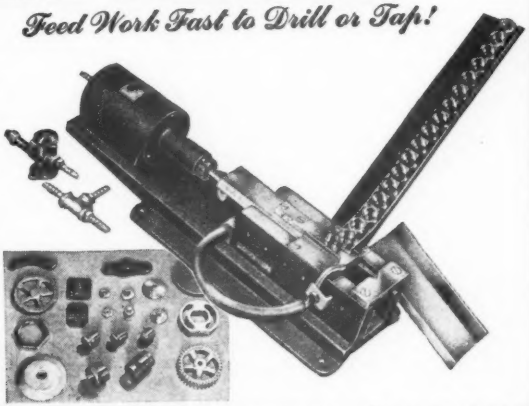

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land 3, Ohio, or use INFORM-A-GRAM Key No. J15-O.

CUTTING MATERIALS TO CLOSE TOLERANCE LENGTHS is the function of Campbell Abrasive Cutting Machines. Materials from small diameter tubing up to 12" bar stock can be cut by some one of the machines described in bulletin DH-1295. Copies of this bulletin will be sent on request from ANDREW C. CAMPBELL DIV., AMERICAN CHAIN & CABLE CO., Dept. 1-85, Bridgeport, Conn., or use INFORM-A-GRAM Key No. 185-O.

BLANKING, PIERCING, FORMING, TRIMMING, AND BROACHING OPERATIONS, performed on the Denison HydrOlLic Multipress, are described in a well-illustrated brochure just published. This Multipress represents a planned effort on the part of Denison to produce a hydraulic "Power Package" specifically for the multitudinous small jobs of industry. Copies of "Multipress and how YOU can use it", will be sent on request from THE DENISON ENGINEERING CO., Dept. 2-60, 1197 Dublin Rd., Columbus 16, Ohio, or use INFORM-A-GRAM Key No. 260-O.

STANDARDIZED, INTERCHANGEABLE PUNCHES AND DIES, retainers, composite die sections, and rubber strippers, which have an important function in the sheet metal fabrication field, are fully described and illustrated in a new catalog of complete R-B products. A technical data section is included giving hardness conversion tables and a stamping pressure chart. Copies are available from RICHARDS BROTHERS, Division of Allied Products Corp., Dept. 59, 1560-74 E. Milwaukee Ave., Detroit 11, Mich., or use INFORM-A-GRAM Key No. F59-O.

GRINDING, BUFFING AND COUNTERSINKING in small corners and tight places is easily accomplished with the Flexible Shaft Utility Tool. Weighing but 8 pounds, its portability stems from the fact that the 1/15 hp motor need only to be hung on any convenient hook, connected to an outlet and it's ready to operate. Detailed information will be sent on request from THE DUMORE CO., Dept. 5-61, Racine, Wis., or use INFORM-A-GRAM Key No. 561-O

DEPTH PERCEPTION (third dimension) and good magnification are vital to many industries and professions. Super Sight-Head Loupe Model 502 is an efficient aid to vision for all whose work is so fine that magnification is needed to get best results. This magnifier is described in "Super Sight", a folder issued by BOYER-CAMPBELL CO., Dept. 67, 6540 St. Antoine St., Detroit 2, Mich., or use INFORM-A-GRAM Key No. 67-O.

MEASURING AND COMPARING VISUALLY, without the errors of "feel", is the procedure when using the Federal Indicating Micrometer. It combines the precision of the dial indicator for uniformity of contact pressure, and for use as a comparator gage, with the accuracy of the micrometer screw for measuring. This instrument is described in literature available from the FEDERAL PRODUCTS CORP., Dept. 4, 1144 Eddy St., Providence 1, R. I., or use INFORM-A-GRAM Key No. 4-O.

GRINDING STEEL WELDS, iron and steel castings and many other operations of buffing and brushing in the metal industry, are performed with the light weight Pneumatic Master Power Horizontal Grinder. This grinder is described in catalog sheet MPT 604 available from the MASTER PNEUMATIC TOOL CO., INC., Dept. 16, Keith Bldg., Cleveland, Ohio, or use INFORM-A-GRAM Key No. J16-O.

INCREASED PRODUCTION BY THE WET BELT MACHINING METHOD, as experienced in several plants throughout the country, is explained and illustrated in Technical Bulletin, New BG-8 by Porter-Cable. One job illustrated was stepped up from 66 pieces per hour with one operator to 2000 pieces with three operators. On request, copies of this bulletin will be sent by PORTER-CABLE MACHINE CO., Dept. 14, Syracuse 8, N. Y., or use INFORM-A-GRAM Key No. 14-O.

GASLESS, FUMELESS AND SMOKELESS WELDING CONDITIONS are experienced when "Blue Flame" welding flux is used. Also, pin holes do not occur in welds with this flux. Detailed information on its application will be sent on request from PROTECTIVE COATINGS, INC., Dept. 4-34, Detroit 27, Mich., Box 3985, or use INFORM-A-GRAM Key No. 434-O.

SHEARING AND FORMING HEAVY PLATES up to 1" thick in mild steel is the function of the Kling No. 100 Rotary Shear. Other models are designed for lighter work, and when equipped with available attachments, a wide variety of sheet metal operations can be performed. Informative Bulletin No. 245 will be sent on request from KLING BROS. ENGINEERING WORKS, Dept. 60, 1300-1334 N. Kostner Ave., Chicago 51, Ill., or use INFORM-A-GRAM Key No. G60-O.

DUCTILITY TESTING OF MATERIALS is facilitated by two new testing machines recently developed. The permanent head of the machine is piloted to the main cylinder body. This provides for the upper grip held in the head and the one mounted on the piston, being always completely concentric and for the penetrator starting the cupping at the exact center of the opening of the grip. The specimen is automatically held between the grips with a load in proportion to the one being applied in cupping. Further information is contained in catalog sheet DTN 646 available from STEEL CITY TESTING LABORATORY, Dept. 79, 8843 Livernois Ave., Detroit 4, Mich., or use INFORM-A-GRAM Key No. E79-O.

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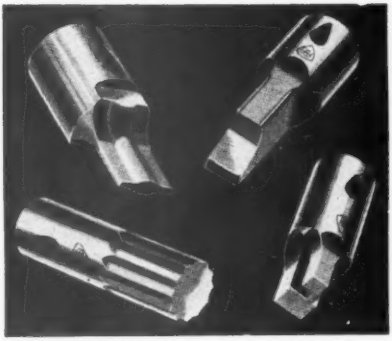

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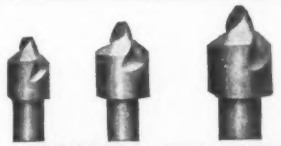

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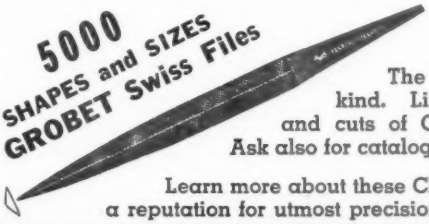

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Learn more about these Chrome Steel Files that have won a reputation for utmost precision and durability—since 1812.

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FOR DRESSING THIN WHEELS

FOR PRECISION SLOT WORK

With the Starn Twin Dresser all wheels in stock can be dressed to size easily and quickly. This aid to the modern tool room is precision made—length over all (including dial) 6¼" — throat depth 1¾" (higher posts are available) — distance between diamonds is 0 to ¾".

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Noted for maintaining original accuracy over a longer period Criterion Heads are smooth, compact, rigid. Parts subject to wear are hardened. Lead screw is hardened tool steel, with threads ground from solid after hardening. All heads have large, graduated dial. Large offset adjustment eliminates need for offset boring bars. Two sizes: 1½" and 3". ½" and 1" bar capacity. Shanks are interchangeable, enabling operator to use head on different machines. Ideally adapted for slide boring tool holder on small turret lathes. Ask your dealer or order direct. Request free literature.

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HANDY
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FAST HEATING
UNIFORM TEMPERATURE

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FAST HEATING—1500° F. in 30 min. Temperature controlled by four point switch set for 500°, 1000°, 1500° and 1850° F. These settings easily changed by adjusting bands on rheostat coils. Dependable indicating pyrometer is calibrated in both Fahrenheit and Centigrade scales.

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PORTABLE—Body is aluminum. Total weight, 17 lbs. Muffle chamber, 4" x 3¼" x 3¼"; furnace overall, 9¼" x 13½" x 10½". Supplied with attachment cord. Operates on A.C. and D.C., 115 or 230 V. (*be sure to specify voltage*). Max. power consumption 1200 watts.

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Precision is a TU-MI-CO tradition

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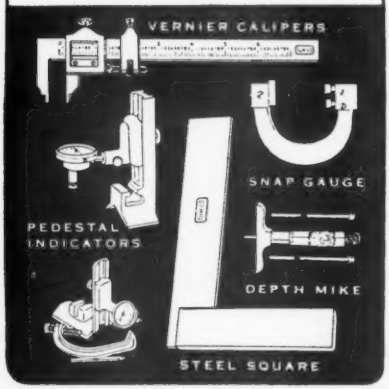

Versatile 24 Inch Disc Grinder

A grinder, adaptable for all kinds of grinding on metal, wood or plastics, is now available for reasonable delivery by The Kindt-Collins Company. This Master 24″ grinder supplies all specific disc

speeds required for grinding these three materials. Special features of the machine include: a heavily ribbed, normalized and machined table; table tilts 45° down and 25° up by worm and gear drive; both faces of the grinding disc may be used; circular and core print fixture has a capacity of 22″ diameter and is wedge-shaped with 10° angle. The disc accommodates both flexible back cloth and paper back abrasives.

Model A of this grinder is equipped with its own dust collection system. Model B has a 4″ exhaust tube for attaching to the plant dust collecting system.

Complete details and specifications on these versatile grinders may be obtained by sending a request to The Kindt-Collins Company, Dept. DJ, 12651 Elmwood Avenue, Cleveland, Ohio, or by using our postage-free INFORM-A-GRAM Key No. D74-O.

Popular With Users Everywhere

This rugged, precise No. 4U Universal Grinder usually becomes one of the most popular machines on the floor either in production shop or tool room. That's because there's no grinding operation light or heavy, within its capacity, that it doesn't handle smoothly, efficiently. Its cost is moderate.

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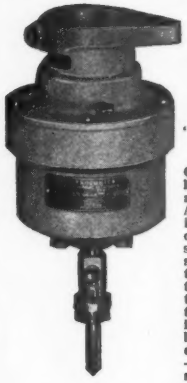

for Fast, Accurate Tapping

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The new "Tru-Grip" is a smaller, lighter and more accurate tap holder. A broached section in the chuck receives the flattened surfaces on the spring collet, while the tap has a positive drive through the square hole in the collet. The tap is held in alignment by the round and driven by the square — taps are never scored.

★Cover clamping eliminates chatter

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The Procunier cover clamping tapping head clamps directly to the drill press quill for greater rigidity and freedom from chatter. Vibration and the tendency to "run-out" or "bell mouth" is minimized. Procunier Hi-Speed Tap Heads are precision built for accurate tapping at high speeds. Driven by a cork-faced friction clutch, the tap is protected by a soft "cushion" effect. Operators quickly detect the presence of a dull or "loaded" tap by the amount of pressure needed to drive the tap. The clutch instantly slips should the tap strike bottom or stick due to tap loading.

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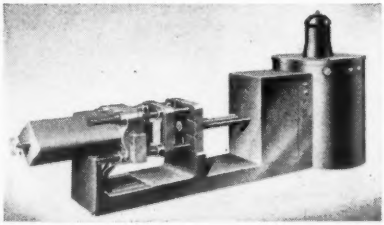
Automatic Hydraulic Cold Chamber Machine

A machine for high pressure casting of aluminum, magnesium and zinc alloys is featured by H. L. Harvill Mfg. Co. The output is high for this type of cold chamber equipment and under typical production methods it has averaged 300 shots per hour. It is equipped with an electric timer and limit switch for full automatic control, or it may be operated semi-automatically or manually. Water hydraulics are used throughout the equipment, completely eliminating fire hazards which is important when the machine is used as an integrated part of a production line. The special hydraulic system can be varied from 200 lbs to 1000 lbs pressure input to the cylinder, with pressure on the locking cylinder automatically increased to compensate for increased shooting pressure. The hydraulic opening and closing cylinder provides motion for opening and closing of dies, but does not take the shock of metal injection. A mechanical method of locking the dies



results in a transmission of this shock to the structural members of the machine. An automatic continuous metal feeding device has been developed to convert the equipment to automatic zinc and aluminum operation. The use of this conversion unit replaces two conventional machines, a cold chamber and a hot chamber or "gooseneck" machine. A 24-page brochure "Die Cast Your Product" may be obtained by request on a company letterhead to H. L. Harvill Mfg. Co., Dept. DJ, P. O. Box 335-P, Vernon, Calif. INFORM-A-GRAM Key No. F5-O.

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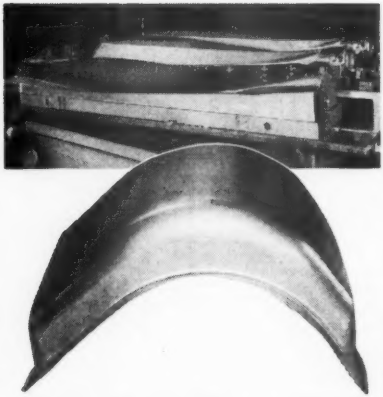

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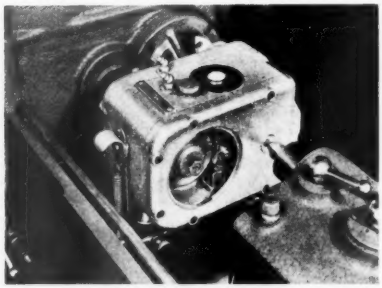
Many single point thread grinders can be converted to multi-ribbed wheel work with a Sheffield semi-automatic diamond dresser. The advantage of more than one rib on a grinding wheel has long been recognized but the dressing problem prevented its widespread usage. In single rib grinding, one rib bears the entire load, whereas the load is divided on the multi-grooved wheel.

The device, mounted between centers



of the grinder, is actuated by the driving pin on the face plate. A precision ground cam for the required pitch is mounted on an accurately ground and lapped spindle and controls the movement of a suitable diamond. The reciprocating movement of the diamond in conjunction with the uniform lateral motion imparted by the leadscrew results in the desired wheel profiling action.

It is recommended for use on: work demanding long lengths of thread and where the breakdown of a single point wheel necessitates making a number of passes; thread gage grinding for elimination of thick first and last threads; maintenance of minimum lead variation; all fine pitch threads over 32 tpi; where the wheel is to be dressed at the required helix angle; and where it is desired to traverse grind and the sharp corner and small radii exceed the limits of crush dressing.

Complete details may be obtained from The Sheffield Corporation, Dept. DJ, Dayton 1, Ohio, or use our INFORM-A-GRAM Key No. 24-O.

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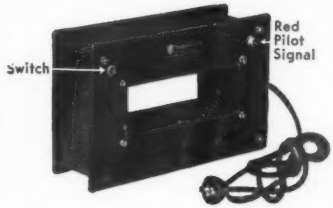

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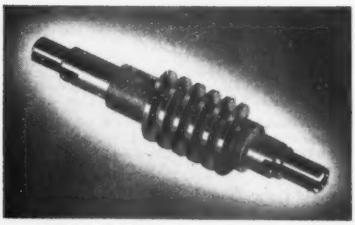

Worms or threads, spindles or valves . . . small parts and assemblies whatever their nature . . . are all the same to Ace. Where precision is required, we will produce it, and in production quantities. Send a sample, blueprint, or sketch for quotation.

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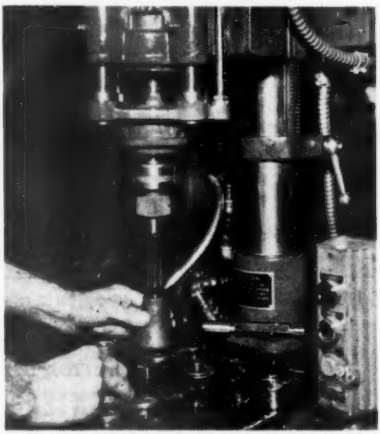
Precision Tapping

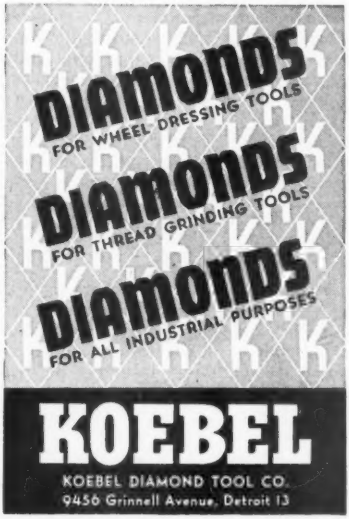
The new type of automotive spring hanger can be threaded on a Detroit Tap & Tool light duty tapping machine in only eight seconds. These hangers have thread designs which provide a greater area to resist radial and thrust loads, and therefore result in decreased wear.

The operation consists of precision tapping to a depth of $1\frac{13}{64}$" with a standard Detroit six-flute tap, ground with a four-thread chamfer. The tap is mounted in a floating tapholder and the work is placed on a simple two-pin locating fixture. Clamping is unnecessary, since this lead screw type machine eliminates the tendency of the tap to bind on the return stroke. The tapping cycle is semi-automatic (tap, return, stop) to assure positive feeding at the high spindle speed of 400 rpm. The tap will produce over 5000 pieces between grinds, even at close tolerances.



With these new hangers, the mounting of truck springs is simplified: variations in frame alignment can be taken up at the mount; spring eyes can have wider axial tolerances; and the installation of locking devices is eliminated.

The Detroit Tap & Tool Co., Dept. DJ, 8432 Butler Ave., Detroit 11, Mich., will furnish complete details, or use our INFORM-A-GRAM Key No. 134-O.



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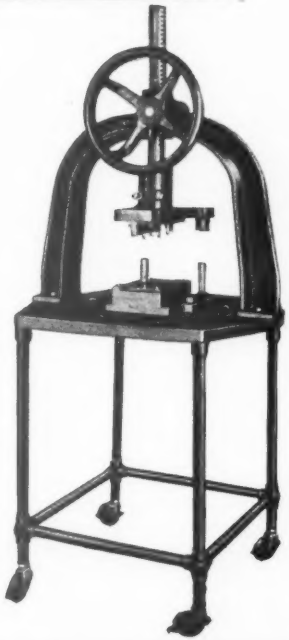

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Here is a truly "one man" press that operates with one hand and under full manual and visual control.

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The Lacey Die-Set machine is sensitive for delicate work yet rugged enough for fitting up heavy die-sets. Useful, too, for shearing certain types of punches.

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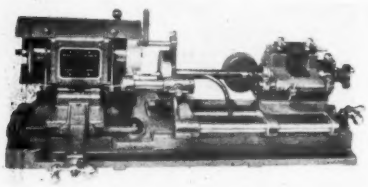
740 Union Ave. Bridgeport 7, Conn.

Blake Thin-Body Chuck

The development of a new type of universal chuck, which depends on a single, pinion-operated, three-lobe cam to move its jaws, is announced by the Edward Blake Company. The turning of a pinion with an Allen wrench actuates the cam which closes the jaws on the work. A spring acts on each jaw to hold



it open when the cam is turned in the pressure-relieving operation.

This new cam-chuck was especially designed for the the bent shank tapper tap attachment used on the Blake tap grinder, as shown in the illustration. When used with the attachment, the thin body allows the insertion, shank end first, of bent and hook shank taps; and enables the gripping of the shank very close to the threads, where the concentricity of the shank with the threads is greatest. Its thin body is particularly advantageous for applications where overhang must be eliminated, or the work area is limited. Its light weight enables quicker starting and stopping of the spindle.

The design principles allow the development of great jaw pressures, thus insuring a positive grip on the work. The chuck holds taps having diameters from $\frac{1}{16}$" to $\frac{5}{16}$", thus eliminating a large number of collets. They are hardened and ground throughout, assuring accuracy and long life. They can be made with two, three or four jaws, which may be formed to hold odd-shaped pieces.

The Edward Blake Company, Dept. DJ, 634 Commonwealth Ave., Newton Centre 59, Mass., will send specifications. INFORM-A-GRAM Key No. 79-O.

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1/16	7/8	2-1/2	1/16	3.00
5/64	7/8	2-1/2	5/64	2.75
3/32	7/8	3	3/32	2.50
7/64	7/8	3	7/64	2.25
1/8	7/8	3-1/2	7/64	2.00
9/64	7/8	3-1/2	1/8	2.50
5/32	1	4	9/64	2.50
11/64	1	4	5/32	2.50
3/16	1-1/8	4-1/2	11/64	2.50
13/64	1-1/8	4-1/2	3/16	3.00
7/32	1-1/4	5	13/64	3.00
15/64	1-1/4	5	7/32	3.00
1/4	1-1/2	6	15/64	3.00
17/64	1-1/2	6	1/4	3.25
9/32	1-1/2	6	17/64	3.25
19/64	1-1/2	6	9/32	3.25
5/16	1-1/2	6	19/64	3.25

Subject to 60% disc. (plus UPA adj.)

Straight Shank, Spiral Flute, Chucking Reamers

Dia.	Flute Lgth.	O/A Lgth.	Dia. Shank	List Price
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1/8	7/8	3-1/2	7/64	2.20
5/32	1	4	9/64	2.75
3/16	1-1/8	4-1/2	11/64	2.75
7/32	1-1/4	5	13/64	3.30
1/4	1-1/2	6	15/64	3.30
9/32	1-1/2	6	17/64	3.60
5/16	1-1/2	6	19/64	3.60

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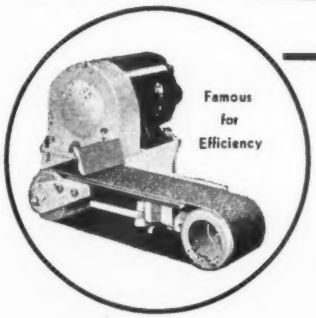

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Anderson Power Scraper

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The left hand serves as a guide to the blade, while the right hand controls the stroke. A slight forward pressure on the cylinder with the right hand starts a swift, smooth stroke, 60 fpm. Pressure of the left hand controls the depth of the cut. The forward stroke can be regulated from ¼ inch to 3½ feet. An operator can scrape right up to the shoulder without slowing his work, since an automatic clutch disengages when the blade touches the shoulder. Anderson Bros. Mfg. Co., Dept. DJ, 1907 Kishwaukee Ave., Rockford, Ill., will send information. INFORM-A-GRAM Key No. 190-O.

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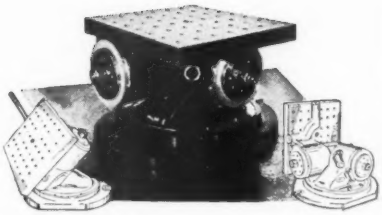

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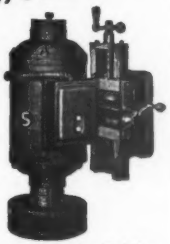

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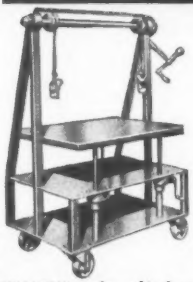

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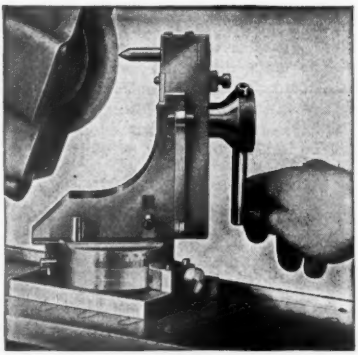

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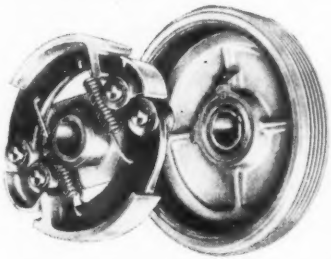
This clutch offers the advantage of fluid drive and in addition permits com-



plete disengagement while idling and positive engagement when driving, with no possibility of slippage. The clutch is an opposed shoe type, dual-spring balanced, to give the desired degree of tension required for individual applications. It idles below the predetermined rpm of an engine or motor and when the driving rpm increases beyond the stipulated rpm the expansion shoes press outwardly, contacting the friction lining of the drum.

Two models are available, one for a range from fractional up to 3 hp with a drum diameter of 5¼" and a length of 2$\frac{1}{16}$"; and the other, a model for up to 6 hp, has a drum diameter of 7¼" and a length of 4½". Different drives such as: gear, sprocket, V-belt or flat belt pulley, coupling or a variable speed transmission, can be mounted on the shaft.

More detailed information regarding this mechanical clutch, which is adaptable for hoists, blowers, spray equipment, scooters, pumps, lathes, etc., may be obtained from Salisbury Motors, Inc., Dept. DJ, 4464 District Blvd., Los Angeles 11, Calif., or use our INFORM-A-GRAM Key No. G70-O.

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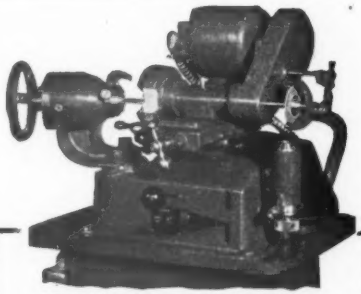

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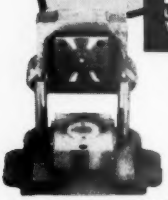

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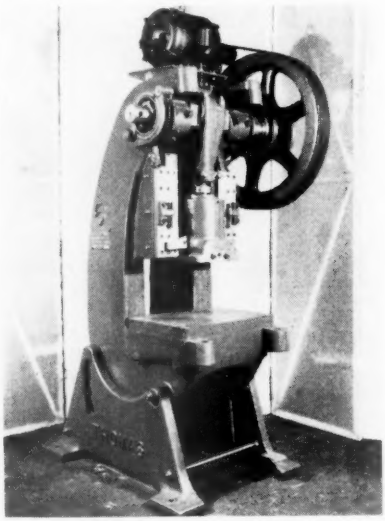
The new open back inclinable presses, designed by Thomas Machine Mfg. Co., offer numerous improvements in design, construction and operation. The one-piece forged high carbon steel crankshaft is of exceptionally rigid design



with ground and polished bearing surfaces. The unusually large bronze bushed main bearings are of the 45° split type, transmitting the thrust directly to the semi-steel frame. The flywheel can be backed up without damage to the clutch mechanism. A patented safety clutch permits either single stroke non-repeat, or continuous operation. Presses can be locked out of operation when setting dies or making adjustments.

A safety stop, incorporated in the shaft, will prevent accidental dropping of the slide if the brake should fail to stop the shaft at the top center. Thomas Machine Mfg. Co., Dept. DJ, Pittsburgh, Pa., will send details on these 50, 75, and 100-ton capacity presses. INFORM-A-GRAM Key No. 994-O.

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Saves Set-Up Time

Case hardened for long life; chrome plated for rust prevention; easy to keep clean.

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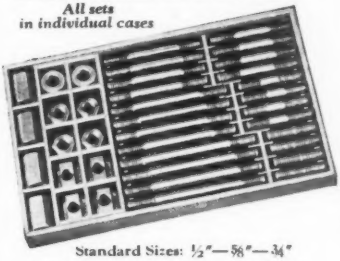

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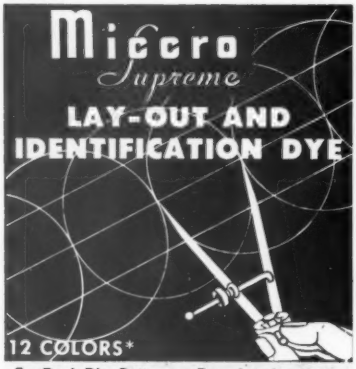

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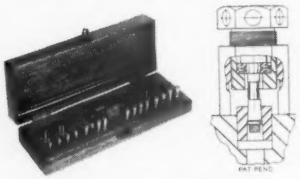

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These extractors have been engineered and developed to do a job in a manner not possible before.

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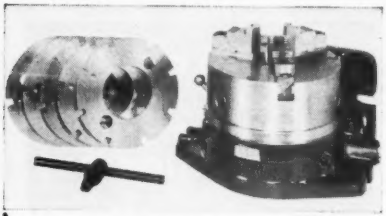

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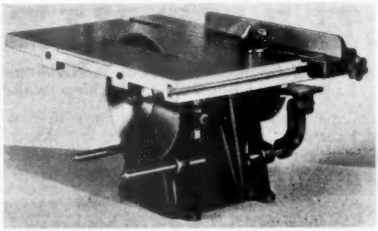

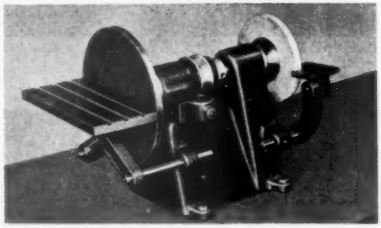

It can be made into a power saw in a few minutes. The work rest used with the sanding is removed by loosening two set screws, the sanding table lifted off, the sanding disc replaced with an 8" saw blade and the power saw table set into place. Adjustment for height is made by the set screws attaching the table to the frame. The saw table tilts a full 45° for irregular cutting.

The design of the saw table is such that "Dado" heads may be used for routing, etc. A movable plate slides away from the cutter; a fixture is attached to the table edge in the mounting holes provided and a "Dado" tool is attached to the shaft in place of the saw blades.

Parlec Power Tools, Dept. DJ, 919 E. Redondo Blvd., Inglewood, Calif., will send complete specifications. INFORM-A-GRAM Key No. H56-O.

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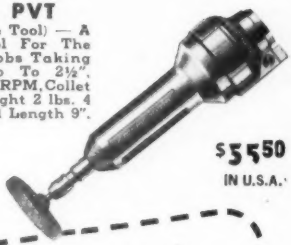

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360° Graduations In Three Planes

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DIE JACK

These Die Jacks eliminate old-fashioned, unsafe, prying or hammering methods. Just clamp on punch holder and turn handle. Punch holder is raised or lowered smoothly, always under control. PERSSON Die Jacks are precision built from fine steel and alloys—a tool every tool maker will want for his tool box or bench drawer.

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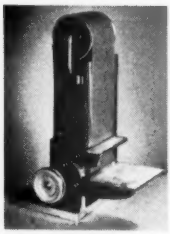
THE WOODS MODEL 40 BELT SANDER



A Husky Little Sander Able To Do A Wide Variety Of Jobs Performed On Larger, More Expensive Machines

SPECIFICATIONS:
Standard Abrasive belt—4" x 35".
Bench Space—9" x 15".
Motor recommended—⅓ h. p.
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Shipped F.O.B. our South Norwalk plant.
Standard equipment includes two working dams, the new reversible work platen, and 3 sanding belts in grits #80, #120 and #180.

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Bearings—Heavy duty New Departure dust sealed ball bearings throughout.

The only small sander with drive shaft supported on both ends of the shaft for longer bearing life and smoother operation.

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Reversible platen—either face of platen can be used thus assuring a continual flat work surface.

Tool Grinder—a small rest for grinding tools is supplied.
Two positions—light weight of machine makes it easily operated in either vertical or horizontal position.

Pulleys—large weight aluminum 4" x 4½" to increase life of belt.

Positional platen 4" x 6"—adjustable to any angle.
Belt Tracking and tension are accomplished with simple thumb screws.

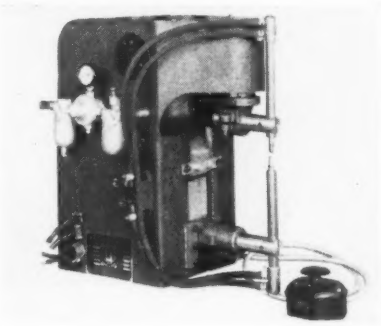
Shafting—supporting moving parts is ⅝" diameter and piston ground.

WOODS ENGINEERING CO. • Norwalk, Conn.

New 7½ KVA Automatic Spot Welder

The 7½ kva midget automatic bench type air-operated spot welder is now in production at the Universal Welder Corp. It closely parallels the popular 3 kva welder used extensively in the manufacture of radio and electrical steel parts, toys and household novelties. It also embodies several unique features, suggested by the users of the 3 kva midget.

Four steps of adjustable weld heat control deliver a secondary maximum of 12,500 amperes. Two thicknesses of 16 gauge clean sheet steel can be successfully welded on this machine. An air accessory unit consisting of an air filter, air regulator, pressure gage and air lubricator insures clean lubricated air to the air cylinder. The operating equipment includes: an improved pressure switch, fast four-way solenoid air valve, a long life heavy duty butt contact type in-built welding contactor, an air flow regulating valve for adjustment of point impact speed, and a convenient foot switch and water cooled electrode holders for No. 1 Morse taper welding tips.



The units have a throat depth of 9" but up to 16" can be obtained by factory modification of the upper cylinder press head mounting. The lower arm is adjustable up and down for a wide range of work. Details may be secured from Universal Welder Corporation, Dept. DJ, 774 Carnegie Ave., Cleveland 15, Ohio. INFORM-A-GRAM Key No. H44-O.

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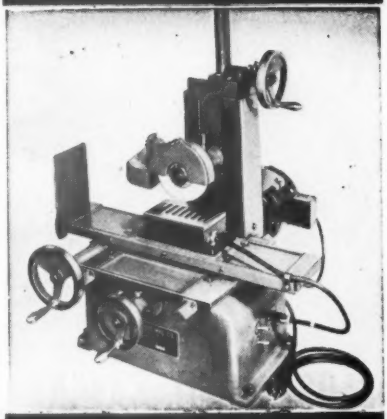

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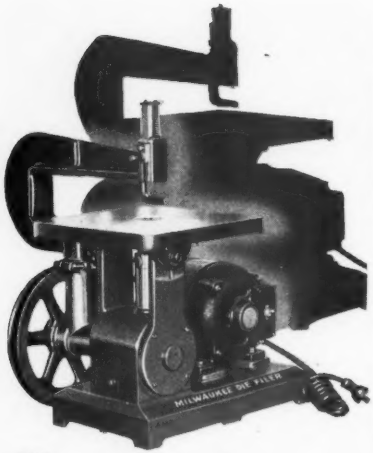

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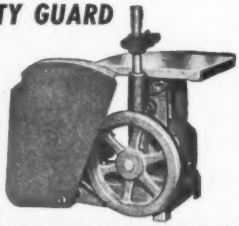

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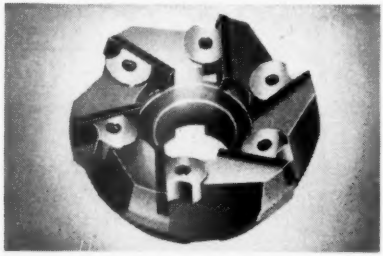

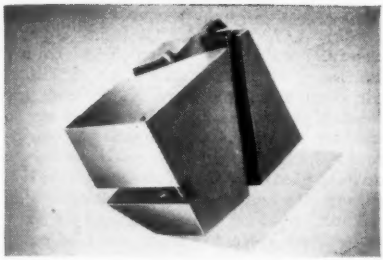

have curved chip bearing surfaces. All cutters larger than 4" have a keyway so they may be used as side mills.

A grinding block, shown above, is also provided to facilitate the sharpening of blades on a surface grinder. Beaver Tool and Engineering Corp., Dept. DJ, 2850 Rochester Rd., R. 1, Royal Oak, Mich., will send complete particulars. INFORM-A-GRAM Key No. G91-O.

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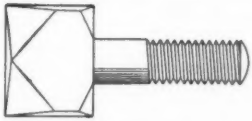

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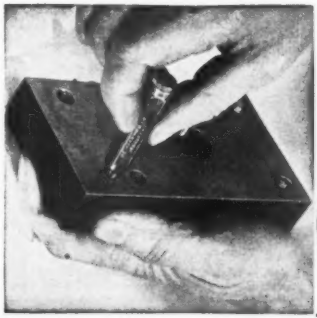

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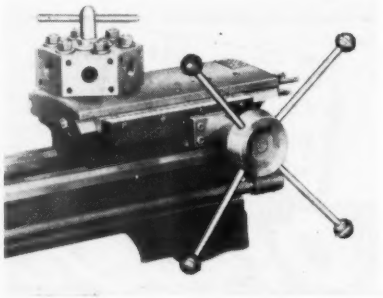

concerning them are obtainable from the Enco Manufacturing Co., Dept. DJ, 4520-24 Fullerton Ave., Chicago 39, Ill. INFORM-A-GRAM Key No. B30-O.

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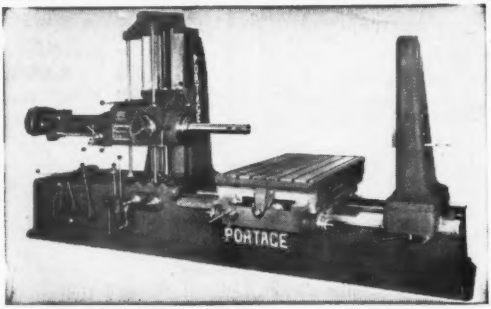

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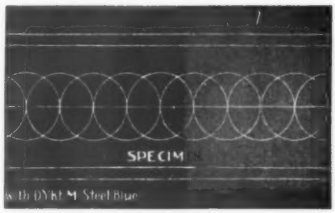

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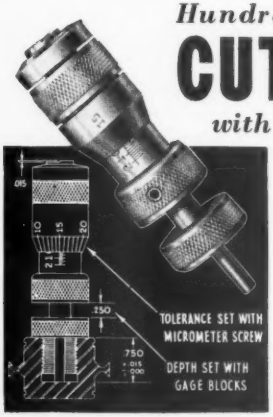

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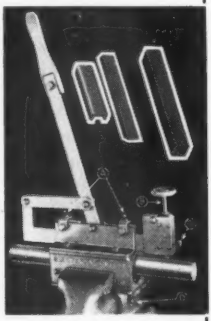

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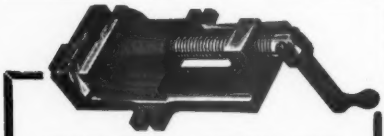

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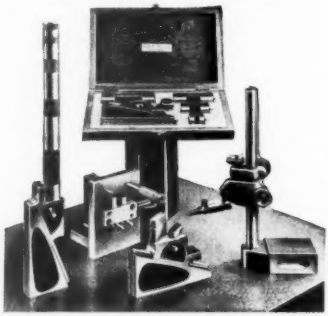

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(CONTINUED FROM PAGE 86)

on an arm which straddles the outside surface. The whole clamping unit mounts on a separate table, which hinges at the rear, superimposed on the planer table. It is provided at the front with an adjustment to align the longitudinal center line of the work with the table travel. The gear box bracket is adjustable on the planer cross rail and the whole mechanism is counter-balanced to incorporate safety, ease of operation, and reduction of wear. Push button control is provided at convenient points for the operator.

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Ace Abrasive Laboratories 151
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Acme Industrial Co. 131
Acme Tool Co. 22
Advance Foundry Co. 140
Allegheny Ludlum Steel Corp. ... . Inside Front Cover
Allen Mfg. Co. 60
Allied Products Corp. 133
Alofs Manufacturing Co. 143
Alvord-Polk Tool Co. 127
American Broach & Machine Co. 63
American Measuring Instrument Corp. 143
Angle Computer Co. 149
Armstrong-Blum Manufacturing Co. ..... Back Cover
Armstrong Bros. Tool Co. 141
Associated Steel Co. 121
Atlantic Tool & Engineering Service 165
Atlas Metal Stamping Co. 151
Automotive Maintenance Machinery Co. (AMMCO) 45

Barrett-Cravens Company 149
Barth Stamping & Machine Works 28
Baumbach Mfg. Co., E. A. 152
Bellows Co., The 3
Benton Co., The 113
Boggis & Co., Henry P. 153
Bokum Tool Co. 42
Boldue Specialties Co. 156
Bunell Machine & Tool Co. 66
Burke Machine Tool Co. 137

Carboloy Co., The 124
Carborundum Co., The 36-37
Carpenter Steel Co., The 151
Center Scope Products 165
Cerro de Pasco Copper Corp. .. 129
Chicago Rawhide Manufacturing Co. 150
Chicago Tool & Engineering Co. 157
Chicago Wheel & Mfg. Co. 7
Cimcool ..... Front Cover
Cincinnati Milling Machine Co. 68-69
Cleveland Twist Drill Co., The 23
Cleveland Universal Jig Co. 165
Clinton Machine Co. 169
Colonial Bushings, Inc. 158
Columbia Tool Steel Co. 124
Conrad & Moser 165
Continental Tool Works, Div. of Ex-Cell-O Corp. 73
Cooley Electric Mfg. Corp. 62
Cosa Corporation 29
Cratex Mfg. Co. 135
Criterion Machine Works 134
Crucible Steel Co. of America .. 43

Dahlstrom Mfg. Co. 142
Danly Machine Specialties, Inc. 11
Darwin & Milner, Inc. 152
Davis Pattern & Mfg. Co. 165
Davis Tool & Engineering Co. 165
Denison Engineering Co., The .. 40
Denning Manufacturing Co., The 165
Detroit Die Set Corp. 38
Detroit Reamer & Tool Co. 72
Detroit Stamping Co. 57
DeVlieg Machine Co. 20
Dickerman Mfg. Co., H. E. 15
DoALL Company, The 71
Dreis & Krump Mfg. Co. 165
Dressel-Betz Co. 165
Dykem Co., The 163

East Shore Machine Products Co. 137
Economy Engineering Co. 48
Evans Reamer & Machine Co. .. 14

Fakes & Co., Joseph B. 166
Federal Products Corp. 78
Firth-Sterling Steel Co. 13
Fish-Schurman Corp. 142
Ford Mfg. Co., Inc., M. A. 113

Gage Co. 70
Gairing Tool Co., The 122
General Die & Tool Co. 165
General Engineering & Mfg. Co. 27
Genesee Mfg. Co. 51
Gibson Co., The Wm. D. 148
Gits Bros. Mfg. Co. 124
Gorton Machine Co., George .. 33
Greenfield Tap & Die Corp. .. 8
Grinders & Fixtures, Inc. 157
Grobet File Co. of America ..133, 164

Hamilton Tool Co., The 119
Hardinge Bros., Inc. 74
Hartford Special Machinery Co. 156
Haynes Stellite Corp., Unit of Union Carbide & Carbon Corp. 6
Heimann Mfg. Co. 161
Hoggson & Pettis Mfg. Co. 111
Holo-Krome Screw Corp. 5
Hovis Screwlock Corp. 154
Huebner Publications 30-31

Ideal Tool & Die Co., Inc. 129
Industrial Machine Co., The 165
Ingersoll Milling Machine Co. .. 75
Inter-State Designing & Tool Co. 161

J & S Tool Co. 152
Johnson Gas Appliance Co. 122

Kearney & Trecker Products Corp. 67
Kiffer Tool & Die Co. 165
Knight Machinery Co., W. B. .. 47
Koebel Diamond Tool Co. 145

Lafayette Tool & Supply Co. 163
LaSalle Sales & Mfg. Co. 166
Lempco Products, Inc. 50
Lincoln Park Mfg. Co. 165
Logan Engineering Co. 24
Lucas & Son, Inc., J. L. 164
Lufkin Rule Co., The 141

M-B Products 117
Madison-Kipp Corp. 157
Marco Mfg. Co. 145
Masonite Corp. 32
Masterform Tool Co. 54
McKinney Tool & Mfg. Co. .. 16-17
Mead Specialties Co. 131
Metal Cutting Tools & Mfg. Co. 146
Meyers Co., W. F. 46
Michigan Chrome & Chemical Co. 155
Michigan Tool Co. 139
Milwaukee Chaplet & Mfg. Co. . 160
Minn-Kota Foundry Mfg. Co. .. 139
Modern Motor Drives Div., The Nichols Engineering Co. 166
Monarch Machine Tool Co. 65
Moore Special Tool Co. 117, 145

National Machine Tool Co., The 155
National Tool Salvage Co. 121
Nielsen Tool & Die Co. 147
Noble & Stanton, Inc. . 106, 155, 165
Norton Co. 12

Oakland Engineering Co. 149
Oliver Instrument Co 161
O'Neil-Irwin Mfg. Co. 56

Paramount Tool Co. 165
Persson Mfg. Co. 158
Phoenix Machine Co. 165
Portage Machine Co., The 162
Pratt & Whitney, Div. Niles-Bement-Pond Co. 34
Precise Products Co. 111
Procunier Safety Chuck Co. 138
Production Machine Co. 137
Putnam Tool Co. 9

R & L Tools Co. 18
Rane Tool Co. 165
Reid Brothers Co. 26
Roberts Rubber Co., Weldon, Brightboy Industrial Division 163
Rockford Die & Tool Works, Inc. 165
Rockford Machine Tool Co. 53
Rusnok Tool Works 142

Sanford Mfg. Co. 159
Schnacke Mfg. Co. 164
Schraner & Co., A. P. 165
Scientific Lubricants Co. 164
Shore Instrument & Mfg. Co. .. 161
Simonski, Gilbert S. 55
Smit & Sons, Inc., J. K. 52
Sommer & Adams Co., Subsidiary The Federal Machine & Welder Co. 76
South Bend Lathe Works 64
Spitfire Tools, Inc. 49, 115
Springfield Machine Tool Co. .. 58
Standard Electrical Tool Co. .. 149
Standard Pressed Steel Co. 107
Star Machine & Tool Co. 25
Starn, G. W. 134
Strand & Co., N. A. 139
Strong, Carlisle & Hammond Co. 115
Sunnen Products Co. 59
Super Tool Co. 19
Swedish Gage Co. of America .. 119

Tamms Silica Co. 145
Taylor Machine Co. 163
Thermo Electric Mfg. Co. 135
Thompson & Sons Co., The Henry G. 61
Thompson Industries, Inc. 41
Threadwell Tap & Die Co. 127
Tools & Gages, Inc. 35
Tubular Micrometer Co. 136
Turchan Follower Machine Co. .. 10

Ulmer Co., The J. C. .... Inside Back Cover
Universal Grinding Co. 154

Variety Machine & Stamping Co. 165
Viking Tool & Machine Corp... 165
Vimco Mfg. Co. 117

Walls Sales Corp. 147
Watts Bros. Tool Works 157
Webber Gage Co. 39
Welding Equipment & Supply Co. 44
Wheelock, Lovejoy & Co., Inc. .. 153
Whistler & Sons, Inc., S. B. .. 170
Wilson, K. R. 21
Wing-Valentine Co. 147
Woods Engineering Co. 158

Yost Mfg. Co. 166

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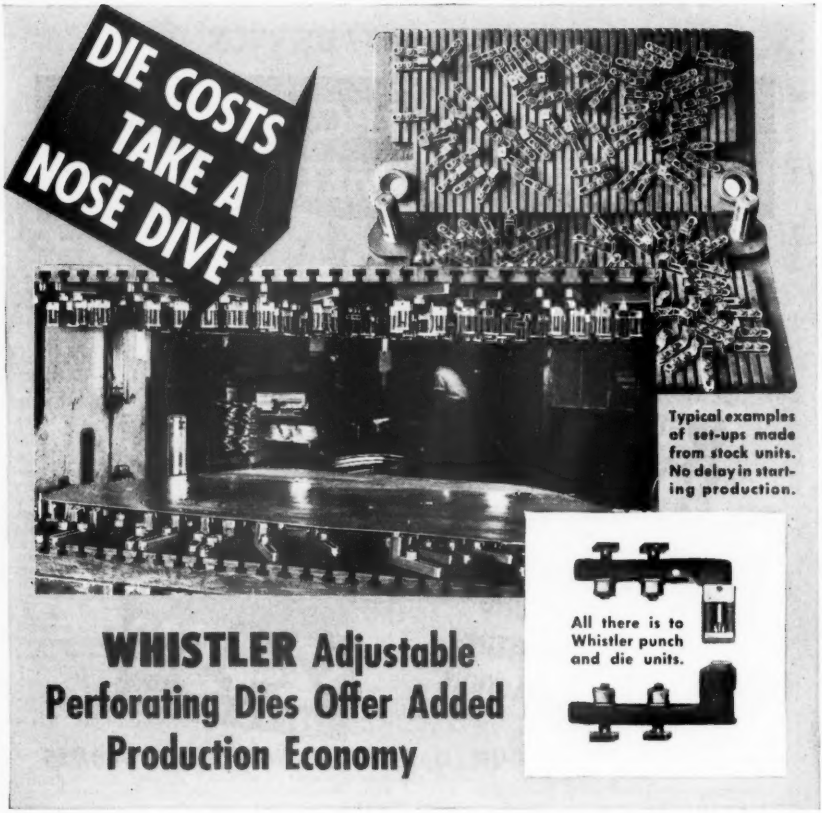
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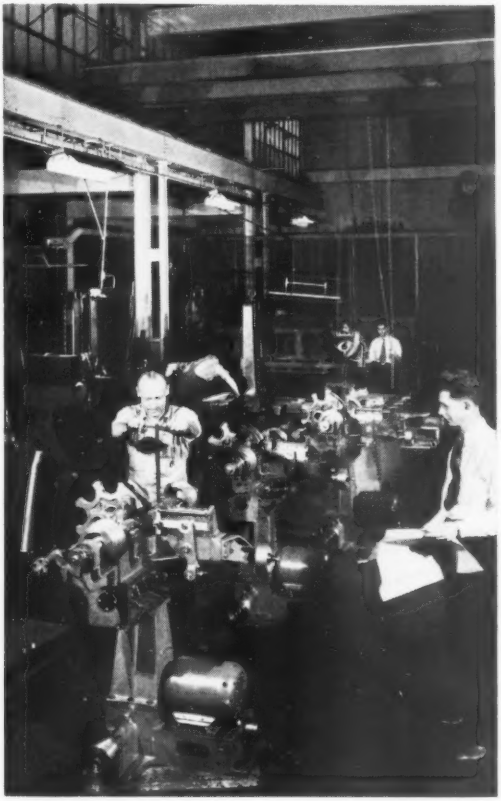

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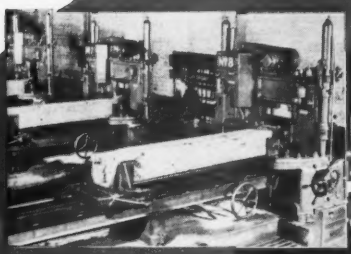

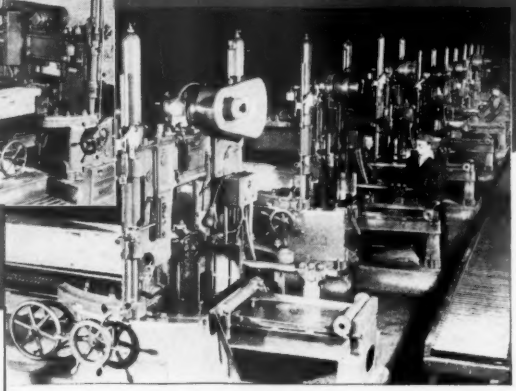

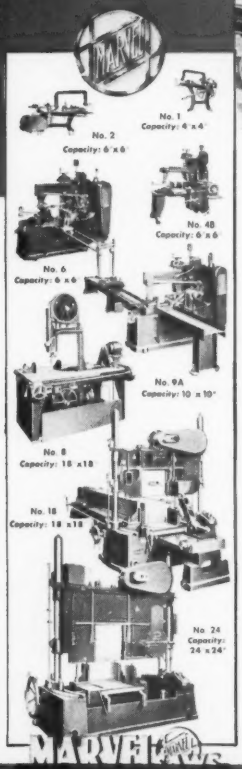

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